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Keep Cool.

It is, perhaps, not too early for us to be saying a few words to each other all around about the necessity of keeping cool. It is better to say them early than late. The reminder cannot possibly do harm, and it may give an additional brace to some who are apt to need it. We are approaching a hot time. The coming summer promises to bring with it an unusual combination of disturbing conditions. The heat of July and August is trying enough at the best, but this year we have several things coming together to add to our discomfort. The discomfort, if that were all, we could worry through with, in the confident hope of smoother sailing further along, only that what causes the discomfort seems often to have a more or less permanently damaging effect. When the cause of the discomfort with which we have been struggling has ceased to act we still are tired and more or less out of breath, and it takes time for us to settle down again into our quiet ways, so that it is well to cling to them as resolutely as possible.

We are in the midst of a time of business prosperity, a prosperity in which all classes of the community are to some extent sharing, and there is good prospect of the continuance of our profitable industrial activity for a considerable period, if not of a more pronounced, extensive and stable state to come, if the conditions now operative are not interfered with. It would be a lamentable thing to have our affairs upset unnecessarily, and by agencies that might be averted. We all want to keep at work at paying rates, and as things stand there is no good reason why we should not. If we could only learn to treat all the other disturbing influences as we have learned to treat the weather, there should be no cause for apprehension.

Of course, the supreme bugaboo of the present year is the Presidential election. If these elections came every year, as the hot weather does, we would become as accustomed to them as we are to the weather, and we would not allow them to disturb us any more than the weather does, and there is little reason why they should. When the canvass is in progress we are apt to become for the time more or less eager partisans on the one side or the other, and we strongly think that if things do not go our way it will be calamitous for the nation. One side honestly thinks this as much as the other, and one or the other is always disappointed. After every election there are nearly one-half of the people who, if consistent, should regard the result with serious apprehension, but the nation continues to stand as strong as before, and if any industrial derangements occur they are not lasting, and, as far as they do extend, they are largely due to the sentiment of the disappointed partisans to whom prosperity would be hateful if not attributable to the success of their special views. Whether we all honestly try to make the best of things, instead of making the worst of them at all times, both before and after either victory or defeat, much affects the ultimate steadiness and prosperity of the whole. Let no man shirk his political duty, but do it honestly, and whatever the result let him never lose faith in the ultimate common sense and the patriotic intent of the masses of the people. All these things will be seen most clearly and truly by him who keeps a cool head.

The other thing that now clouds the sky is the talk of strife, and in some cases the actual fact of strife, between employers and employed. The relations of these are essentially co-operative, and there is no underlying reason for antagonism. The fact that one is a buyer and the other a seller of labor does not imply enmity any more than do the relations of the butcher and the baker with their customers. Both the buyer and the seller need the consummation of the mutual transaction for the accomplishment of their individual ends. Both the buyer and the seller have always the option of refusing a transaction that is not satisfactory and right. The relations of the shop proprietor and the workman, however, are not precisely the same as those of the grocer and the butcher with their customers, from the fact that there is not the same freedom of movement. The customer has nearly always a choice of places where he may buy, and he has always at hand a ready, and generally sufficient, means of defense in the transferring of his business from one place to another. With the men of the factory, on either side of the business, there is not this same freedom of movement, and therefore not the same ready and effective remedy, and other means have to be resorted to to secure permanent agreement. The employer cannot readily find other gangs of men altogether satisfactory, and the men also find it difficult and costly to fit into other shops. But with the employer and his men, as with the housekeeper and his grocer, the one thing to be secured is the same—a mutual understanding of what is right, and the limit of advantage it is possible to gain on either side. There is nothing more helpful and more promotive of the right adjustment of business relations than a full mutual understanding of each other's possibilities and limitations. There is, perhaps, no more hopeful sign of the industrial situation than the growing disposition to discuss and to arbitrate rather than to fight, and it is here that the exhortation to keep cool fits in. Talk things over fully and freely. Let there be no concealments. Avoid threats and ultimatums which commit either party to a struggle for the maintenance of an untenable position. Whatever occurs, those who keep cool and within their rights are the ones to win.

Money Making Under Paternal Governments.

Consul-General Guenther transmits to the State Department the following from Frankfort, Germany:

"The 'Frankfurter Zeitung' contains a

statement made by a competitor of Krupp with reference to the profits made by Krupp in his contracts with the German Government. He says that some time ago Krupp furnished field guns at $1,145 each. Competitors afterwards received an order for the same kind for $464.30 each. Thereupon Krupp reduced his price from $1,145 to $452.38. For shrapnels Krupp received $2.03; his competitors furnished them at $1.19. It is an error to say that Krupp alone can furnish nickel plates for the navy. The process of manufacture is no secret, but is known by every intelligent manufacturer. If there were competition, the nickel plates could be obtained at half the price paid to Krupp. The navy department, however, prescribes conditions which make competition impossible. Testing grounds are required of the same dimensions as those of Krupp, which belong to the government and have been rented to him. The necessary provisions for testing 24-centimeter guns would cost between $500,000 and $750,000; for 15-centimeter guns, $75,000. Without previous assurances on the part of the government nobody would risk such an investment."

We have not learned what reports the German consuls in the United States transmitted to their home government at the time of the late Carnegie lawsuit.

Examination for Third-Class Electrical Draftsman.

The United States Civil Service Commission announces that on June 21 and 22, 1900, an examination will be held in any city in the United States where it has a local board of examiners for the positio of third-class electrical draftsman.

The examination will consist of the subjects mentioned below, which will be weighted as follows:

Letter writing	20
Mathematics	20
Practical questions	40
Technical education and experience	20
Total	100

Applicants should be familiar with the principles of electrical engineering and construction. The tests in drafting will not require the use of a drawing board, but competitors should supply themselves with a slide rule and two pieces of cross-section drafting paper not less than 8½ inches square.

The examination will be divided into two days of six hours each. The first two subjects will be given on the first day, and the third subject on the second day.

Age limit, twenty years or over.

From the eligibles resulting from this examination certification will be made to the position of third-class electrical draftsman at the New York Navy Yard at a salary of $3.28 per diem.

This examination is open to all citizens of the United States who comply with the requirements and desire to enter the service. All such persons are invited to apply, and applicants will be examined, graded and certified with entire impartiality and wholly without regard to any consideration save their ability as shown by the grade attained in the examination.

Persons who desire to compete should at once apply to the United States Civil Service Commission at Washington, D. C., for application forms 304 and 375, which should be properly executed and promptly filed with the commission.

The Manufacture of Military Rifle Barrels.

Mr. Parkhurst calls our attention to a typographical error which occurred in his article under the above title, printed in our issue No. 17. On page 392, first column, fifth line, read "2 inches," instead of "2 feet."

Technical Publications.

"Industrial Applications of Electricity" is the title of an attractively illustrated pamphlet issued by the power and mining department of the General Electric Company. It is intended to show the advantages of electric motors for driving machinery operating cranes and draw-bridges, etc. While many of the ideas can hardly be new to readers of the "American Machinist," the publication is of interest for the views it contains of heavy machine tools directly driven by motors, and of notable instances of the application of electric power to different kinds of machinery. The numerous manufacturers who to-day are considering the introduction of electricity in their works will find here an interesting statement of the electrical arguments.

"The Compound Engine." A series of lectures by F. R. Low, reprinted from the columns of "Power." New York, The Power Publishing Company. 52 pages, 9x6 inches; 37 cuts. Price 50 cents.

This neat pamphlet comprises three lectures which do not seem to be consecutively numbered, from the valuable series prepared by the author, upon steam and the steam engine. The theoretical and possible practical gains from the use of steam expansively are first discussed, and the study of the indicator diagrams, both singly and combined, is gone into thoroughly, also the important subjects of receivers and cylinder ratios, and as much upon a very large subject as can be got within the limited space is here presented, making the book a serviceable one for all students of the steam engine.

Personal.

Harris Tabor has resigned the presidency of the Tabor Manufacturing Company, Elizabeth, N. J., and Wilfred Lewis has become president and engineer. Mr. Tabor will hereafter act as consulting engineer for the company.

E. R. Keller, of the firm of Keller & Pike, engineers and contractors, lectured to the mechanical and electrical engineering students of the University of Pennsylvania on May 1 on "Electric Wiring."

A. L. Church, of the Baldwin Locomotive Works, addressed the students in mechanical and electrical engineering at the University of Pennsylvania on April 26, on "Adaptability as One of the Requisites of a Successful Engineering Career."

Mr. Percy Martin and Mr. A. P. Zani, of Milan, Italy, are on a tour of this country investigating machine shop construction, equipment and practice, in the interest of the Thomson-Houston Mediterranean Company, who will build large works for the manufacture of electrical machinery in Milan. They expect to remain until about the middle of June.

Obituary.

Oliver L. Stewart, secretary of the Laird Malleable Iron Works, Huntingdon, Pa., was instantly killed May 3, by the bursting of an emery wheel. A piece of the wheel penetrated his heart.

Augustus Large, one of the first locomotive engineers of the Pennsylvania Railroad, died at Belvidere, N. J., April 30, sixty-five years old. He had been in the employ of the company for nearly fifty years, and ran one of the first engines on the Belvidere division.

Charles P. Haughan, president of the Chrome Steel Works, Brooklyn, died in that borough May 1, fifty-eight years old. He was a native of Ireland, and came to this country when a child. He was connected with a gun foundry during the civil war, and later discovered or improved the process for the production of chrome steel, from which a large business has developed.

An old-time machinist, one whom we might perhaps better call an off-and-on machinist, was Jedediah D. Witter, who died at Hope Valley, R. I., April 29, eighty-three years old. He was born in Hopkinton, R. I., began to learn the machinist trade when eighteen, and worked at the trade until he was forty-eight, then he was superintendent of a cotton mill for seven years, then ten years superintending another cotton mill, and after that he was employed in a machine shop until he was eighty-one.

The common use of gas or gasoline engines and electric motors to furnish power for factory purposes is taken direct cognizance of in the preparations for the census enumeration next month, special blanks being left on the schedule of manufacturers for these forms of power, as well as for steam engines, water wheels and the omnibus class, "Other power (specify kind)."

Commercial Review.

NEW YORK, SATURDAY EVENING,
May 5, 1900.

MACHINISTS' AND MANUFACTURING SUPPLIES.

Trade in machinists' supply lines may be broadly characterized as holding on in a way that gives no legitimate cause for complaint. In individual cases, which apparently are numerous, recent months have been unprecedented in volume. By way of illustration, the business of the Cleveland Twist Drill Company for the first four months of this year was better than for the corresponding portion of last. Mr. L. Best, an extensive dealer in emery wheels and machines, charged up more orders last month than in any previous month on record, which, however, represented in part orders booked earlier.

Still, there is considerable complaint of a falling off in trade, and if all facts were known, probably they would show a smaller volume of business than a year ago. The tendency of prices is now to weaken, so far as there is any tendency, one way or the other. On the rougher finished goods, such as shafting, brass sheets, iron pipe, bolts, rivets, wire, etc., there have been decided cuts. Wire nails have dropped $1 a keg, which means that a dealer who has stocked up with 500 or 1,000 kegs is just so many dollars out of pocket, and is not howling "prosperity" quite so loudly as formerly. We hear of one party who has lost on 1,500 kegs. As yet we have received no positive evidence that this weakness in values extends to the small tool line. That in some cases a little hesitation in buying them results from the reductions on other iron and steel products is apparent. Jobbers have begun to manifest a disposition to wait and see what is going to happen, and in the meanwhile to place orders only sufficient to cover the necessities of trade. There is no use in trying to deny that the sympathetic influences of some branches of the iron market are depressing, yet there is no occasion for an alarmist view of the matter. Those influences are being withstood better than might have been expected.

A man who has lately been on a business trip in the near South found an earnest of continued demand for supplies in the contract programs of the large engineering establishments visited in that region. One of them is the Newport News Shipbuilding and Dry Dock Company, which has any quantity of work on hand. The United States Government is to equip a large navy yard shop at Newport News, it is said. The Richmond Locomotive and Machine Works were also very busy. They have the foundations laid for a new boiler shop, which is expected to be made a model of its kind. This company has just shipped to Sweden for the Ystad Eslof Railway three 16½x 24-inch ten-wheeled locomotives, weighing complete 101,000 pounds each.

MISCELLANEOUS.

The commercial conditions created by the European coal famine seem to be disappearing. Consul Hughes, of Coburg, reported March 23 that supplies of coal from Saxony, Bohemia, Silesia and Moravia were again arriving, the strike having practically come to an end on terms offered by the mine owners. It was said that 9,000 men of the 24,000 hands that originally went out on strike were still holding out for better terms.

At the time of the rush to the Klondike gold fields the machinery and supply house, James Beggs & Co., of this city, was prominent in fitting out parties bound for that region. At present there is a similar movement to Cape Nome, Alaska, and the firm is doing an extensive business in equipping mining parties with that destination in view. In the last three months it has supplied seven or eight of these. The outfits include engines, boilers, dredges, steam shovels, separators, amalgamators, and all the accessories of camp life, down to cups and saucers. Some of the larger machines are quite valuable, and the equipments aggregate amounts running up as high as $50,000. Four separating machines were sold only yesterday. In the regular lines of minor machinists' and manufacturing supplies the firm is very busy, having made a better total of sales in the first four months of this year than in the corresponding period of any of the last five years.

According to a dispatch from Constantinople, an irade has been issued by the Turkish Government prohibiting the importation of all apparatus connected with electricity.

The St. Petersburg store of Schuchardt & Schütte was opened at 5 P. M., February 24, on which occasion elaborate ceremonies took place. There were gathered in the store the proprietors and directors of all the important machinery works of the city, professors of technical schools, and others. A dense crowd of people surrounded the building and looked in through the windows. A religious service was held after the ritual of the Greek church. Afterward an exhibition was given of the practical working of some machines electrically driven. Among these was a Cleveland automatic screw machine and a Gould & Eberhardt gear cutter, which attracted favorable interest by the dexterity and speed with which they turned out their respective products. Later on a banquet was held in a restaurant, where toasts were drunk to the success of the new enterprise and of individuals connected with it. The toast of His Excellency San Galli, one of the largest manufacturers in Russia, was received with enthusiasm. The professors of the technical schools express their intention to give instruction at the store to their more advanced pupils. American manufacturers may expect that the influences thus cast about youthful minds will result in future triumphs for American machinery in Russia. Schuchardt & Schütte, it may be mentioned, had been successfully cultivating the Russian market twelve years before fixing upon their present local habitation.

The following, if true, was the experience of a certain company in Cleveland, Ohio, during the late strike of machinists: This concern employs about forty machinists who work nine hours a day, are fed on chocolate caramels, and in all respects live a life of contented indolence and luxury. They, however, were forced to go out on a sympathetic strike. Before long the company made an arrangement with them by which they all came back to work again, each several man being made a *foreman*, and hence exempt from the requirements of the union rules.

A telegraphic dispatch from Santiago de Chile states that Mr. Waters, of Spencer & Waters will soon leave for the United States, under orders of the Chilian Government, to purchase machinery for mining explorations, elevators, and locomotives for new roads.

The Bethlehem Steel Company has lately received an order for crank-shaft forgings for an important installation in Australia from a representative of the engineers, who visited this country in connection with the work. The company will make a hollow-forged steel shaft to replace the wrought-iron one recently broken on the steamer "Puritan," of the New York, New Haven & Hartford Railroad Company. They report a growing demand for high-grade steel shafts and general forgings as a substitute for wrought iron.

The April business of the Chicago Pneumatic Tool Company was a record breaker for any month, both in the number of orders received and the number of tools and appliances ordered. This trade covered every country in Europe and many in the Orient. They report that the manner in which orders for May are flowing in will necessitate their factory running night and day to fullest capacity to fill them promptly.

A complete equipment of Cross oil filters, manufactured by the Burt Manufacturing Company, Akron, Ohio, has been ordered by the Pennsylvania Railroad Company for its Fort Wayne shops. The electric street railway company of Mexico City ordered an outfit, and another is being installed in the Philadelphia mint. A large order will be shipped to Brussels this month.

AMERICANS STEALING A MARCH WITH AUTOMOBILES.

The Germans are behind other nations in entering the automobile industry. The French ambassador at Berlin complains that his countrymen have neglected to avail themselves of this opportunity of capturing the German market. His remarks are echoed, with comment, by our contemporary, the "Chronique Industri-

elle." Hitherto the German duties on motor vehicles have been low and conditions have favored the sale of foreign ones, but now that the Germans are investigating that line and are in a fair way to build imitations, or out and out copies, of the best foreign automobiles, it is believed that they will soon raise the tariff, with an idea of keeping the industry to themselves. Some organs of the German press are already agitating such a move. "The Americans," says the French journal named, "seem to have better than our compatriots understood the necessity of speedily possessing themselves of the German market and assuming a solid position there. A Berlin paper reports in this connection the projects of one of the most important automobile companies of the United States, the Electric Vehicle Company, which contemplates the establishment of branches in Germany, and would create a terrible competition against the national industry."

CHICAGO MACHINERY MARKET.

In reference to new business that is coming up, requiring power, it is observed that a much larger percentage than last season is the equipment of new plants. Last year there was much repair work and much additional power placed to old structures. The capacity of the latter was pushed close to the limit. Further expansion now requires the erection of new buildings. Power suppliers are therefore more intimately affected now than then by the conditions that influence the building trades. Two of these influences of a checking character are now active. One is the continued strikes in the building trades. At Chicago several quite large plants, half completed, have been waiting for the troubles with labor to end. The sombre influence of their half-finished walls has been to deter the conclusion of contracts by manufacturers of dependent lines. The other influence alluded to is the unsettled prices of iron and steel. Quite a large amount of new business is held back until costs are lowered, or until it becomes evident that quotations will yield no further.

But regarding the state of the machinery market, as applied to engines and boilers, there are many indications that it is generally satisfactory, in spite of the clogs alluded to. In the offices of some of the larger sellers there abides an air of cheerfulness that is inconsistent with any other condition than that of satisfactory sales. There is not the "runaway" character to trade that was present during a large portion of last year, but the volume of business is incomparably greater than for any similar period, except the banner months of 1899. One of the largest sellers of boilers in this market says his trade, as compared with the last few months of 1899, shows a slight reduction. Another representative in the same line notes no decrease in the volume of business, but says fewer large orders are being placed. Still others say they can see no decrease in business, even as compared with last season. All agree that, hovering over the market, there are many large orders in suspense, the placing of which will depend upon the satisfactory solution of existing uncertainties.

The Northern Electrical Manufacturing Company, Madison, Wis., reports a steady increase in business and of a very satisfactory character. Ths company has recently equipped the new plant of N. Caldwell & Sons, Chicago, with 100 kilowatts in generators and 80 horse-power motors; G. A. Crosby & Co., of Chicago, with 200 kilowatts in generators and 150 horse-power in motors; the Emerson Manufacturing Company, Rockford, Ill., with about 800 kilowatts in dynamos and 700 horse-power in motors. They have also sold two dynamos and various motors to W. F. & John Barnes Company, Rockford, Ill. They report a large trade in their new electric combination buffing and grinding lathe and blower and their special vertical motors for drills.

Quotations.

NEW YORK, Monday, May 7, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:

No. 1 X foundry	$21 75 @ $23 00
No. 2 X foundry	20 75 @ 22 00
No. 2 plain	19 00 @ 20 00

Alabama Irons:

No. 1 foundry	22 25 @ 22 75
No. 2 foundry	21 25 @ 21 75
No. 3 foundry	20 25 @ 20 75
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 21 75
Foundry forge	19 50 @ 20 00

Bar Iron — Base sizes — Refined, mill price on dock, 2 @ 2.10c., with good brands selling at 2.40 @ 2.50c. from store in moderate quantities.

Tool Steel—Base sizes—Standard quality, 6½ @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.60 @ 2.75c.

Cold Rolled Steel Shafting—Base sizes —From store, 4c.

Copper—In carloads—Lake Superior ingot, 17c.; electrolytic, 16¾ @ 16⅞c.; casting, 16¾c.

Pig Tin—In 5 and 10-ton lots, 29⅝ @ 29¾c., f. o. b., New York.

Pig Lead—The American Smelting and Refining Company has just made a parallel reduction of 30 points at all centers, so that the market for New York is now 4.40c. in wholesale lots, carloads being quotable .02½ @ .05c. extra.

Spelter—Prime Western, 4.65c., New York delivery.

Antimony — Cookson's, 10¾ @ 11c.; Hallett's, 9⅝c.; United States, 9½c.

Lard Oil—Prime City, 62c. in jobbing lots.

The Paris Exposition — I.

EDITORIAL CORRESPONDENCE.

Officially the "Exposition Universelle Internationale de 1900" has been declared opened. Somewhat curiously, the general public was not admitted on the opening day, the 14th, but only those favored persons who could secure or who were tendered invitations to be present to witness the opening ceremonies. Those of our readers who take an interest in it have, of course, long ago read a description of these ceremonies, and they were indeed simple, the chief feature of display being afforded by the soldiery, of which, as might have been expected here in France, there was a considerable show.

THE ANTE-OPENING EXHIBIT.

The best judges put the time required in which to really complete the exhibition at six weeks. That is probably not far from right, and yet a prominent American tool builder, who is broad minded enough and enough of an engineer to take an interest in things mechanical, not directly connected with tool building, told me that he considered that during the six weeks he had been here trying to get on with his exhibit—trying to gather things together to form it (and for the most part failing), he thought he had seen the most valuable, instructive and interesting part of the show. What he had been seeing were the preparations for a great exhibition. He had seen the machines of all machinery building nations coming in in boxes, all the larger machines in parts. He had seen these parts as they lay about, and had had opportunity for noting how the tooling had been done; he had seen them put together, and knew about how much filing of bolt holes, scraping and fitting here and there had been required, and had been much interested in the various methods followed by the different groups of workmen. It is obvious that from a mechanical or engineering standpoint our friend was right, but there is much more of that sort of thing yet to be observed, and so in a sense it may be said that the best part of the exhibit will not close for about six weeks yet. I have seen a good deal of it in the few days I have been here, although the exhibition is so large and there are already so many exceedingly beautiful, grand and inspiring things to be seen, especially in the architectural features, that unless one is a stick or a stone he finds it impossible to confine his attention to those things which especially interest him and to make a hurried survey of them alone.

It is not, mechanically considered, a superficially attractive exhibit as yet, however, and does not look as though it could be for a long time to come. A great deal of the machinery is not yet on the ground, and the ground is, so to speak, not yet prepared for a good deal of it that is here. Chaos seems to reign supreme. The only moving things to be seen in the main machinery exhibit on the Champs de Mars

are one gas engine of perhaps 15 horsepower and a German traveling crane which is being used in installing large engines and other machines in the motive power exhibit. The crane is driven by electricity and gets its current from one of the city generating plants through a rotary transformer. Two engines were ready to run on the opening day and to furnish current; the boilers necessary to supply them with steam were also ready, but they could not be fired because the Worthington pump exhibit, which is to furnish water, was not ready, and experience has demonstrated that boilers do not work any better without water in France than they do in America. For the same reason what was intended to be an important feature of the opening day exercises was missing. As President Loubet passed the Palais de l'Electricitié it was intended to open the valves which control the water supply for the immense and impressive cascade which is to be illuminated with colored electric lights. The engineers are said to have gone through the motions at the right moment, though why they should have done so is a mystery, because they must have known that the result would be nil; as in fact it was, no water being at hand.

Extraordinary efforts had been made for some days (and nights as well) just before the opening day to have things in as presentable shape as possible, and externally most of the buildings grouped about the Eiffel Tower in the Champs de Mars are practically finished. They are not whited sepulchers, of course, but they remind one of them, because, though externally beautiful, inside they are for the most part filled with confusion, packing cases, boards with obtrusive and sharp-pointed nails, dust, sand and fresh paint.

ENGINE EXHIBIT.

Enough has been done to show that the exhibit of stationary engines is going to be a notable one, though it will be confined almost entirely to Continental builders.

Some admirable examples of Swiss, Belgian, French and German engines are erected, but cannot be so well seen now that the exhibition is open as they could before, because then the men were working at them, whereas now that they are ready to run, or for final coats of paint, and are cleaned up, many of them are entirely covered with cloths to protect them from the flying dust and grit, and so cannot be seen at all.

One of the features of the motive power exhibit that is likely to attract most attention is a gas driven blowing engine built at the Cockerill establishment at Seraing, Belgium. It is intended to use the waste gases from blast furnaces, and thus to furnish power from a source hitherto entirely neglected. I suppose no such gas as it is intended to run with will be available here, but whether the engine runs at all or not it will manifestly be one of the most impressive and interesting sights of the exhibition. I do not know its capacity, but the connecting rod, which, when I saw it, had not yet been put in place, measures 12 inches in diameter at its large end, and the crank pin bearing is 18 inches in diameter and 23 inches long, which figures will give an idea of what sort of a gas engine this is.

SPACE FOR AMERICAN MACHINERY.

Much dissatisfaction continues to be expressed with the allotment of space on the Champ de Mars to American exhibitors. The space allowed is ridiculously small, notwithstanding the enlargements that have been secured by repeated and urgent demands. One prominent New England tool builder had at first a space just 2 feet by 3½ feet. As from his entire list of tools he could not select a single example that did not require more floor space than that, he was finally granted 4 feet by 7 feet, which is sufficient to enable him to show one small lathe and to put up a sign telling those who may be interested where, at the Vincennes annex, 4½ miles away, the principal part of his exhibit may be seen.

Great Britain has not fared well in the matter of assignment of space, but other nations have done much better than the United States. This, it is generally agreed, cannot be charged against the French management, for it results from the simple fact that our government was too dilatory in the matter of recognizing the fact that there was going to be an exhibition here this year and applying for space in it. Space was assigned on the barber shop rule of "first come first served," and ours is said to have been about No. 17 on the list, and that no application for space had been made within six months after the time when the Germans had secured their space. This being the case, it is difficult to see how any but ourselves are to blame, and there is nothing to do but to hope that ere another great exhibition is organized our proposed Department of Commerce and Manufactures will be organized and will make it its business to secure every possible advantage to be obtained from such an opportunity to show the world what we are doing and have to offer.

THE VINCENNES EXHIBIT.

The building erected at Vincennes by American tool builders was, we were told, sure to be ready on the opening day. It was not ready and the flooring is not yet entirely complete. Some changes were made in the original plan, which contemplated a gallery on which some of the exhibits were to be located. This was objected to, and the objection resulted in the erection of an annex, so that the building as it stands consists of two bays, one a steel structure and provided with an electric traveling crane, the other of wood and having no crane. The building is 350x125 feet.

Two "Climax" boilers of 250 horsepower capacity each are to supply steam for the building, and these boilers were ready for steam on the opening day. The Ball engine, however, was not ready, because it lacked, and still lacks, that rather important member known as the crank shaft, which is supposed to be somewhere at the bottom of the sea in the French steamer the "Pauillac," which took to the same port so much other American machinery intended to be shown here.

This loss of the crank shaft gave Mr. Drake considerable trouble in carrying out his determination to supply motive power at Vincennes on the opening day, but he finally accomplished it by installing a Willans engine which had been in use for a long time here in Paris and happened to be removed to make way for a larger one. This engine, with its direct-connected generator, enabled current to be supplied to the crane on the opening day, and it is still doing so, pending the completion of other arrangements. Previous to the opening day the crane was worked by hand to move the tools about that were installed up to that time. American exhibitors generally speak well of Mr. Drake and of his management in his position of "Director of Machinery and Electricity" for the Commissioner-General of the United States, and there can be no doubt that he has had a herculean task to perform. He informs me that although there is still much to be done, the worst of it is over, and that when cars now loaded at Havre are delivered and unloaded at the Champ de Mars and at Vincennes 90 per cent. of the American machinery exhibit will be on the grounds. This is being done as rapidly as possible, but to the American exhibitors who have been waiting here for weeks it naturally seems to go very slowly, and there is much vigorous language heard about this feature of the situation, though a few have progressed to the stage of patient resignation to the inevitable, and only remark that there is manifestly nothing to do but wait and in the meantime to enjoy life in Paris as well as may be.

The daily occupation of some of them is to hunt for machinery known to have been landed at Havre, but the precise present location of which is unknown, and when not doing this they are trying to gather other stuff together, cloth covers for their machines, timber for putting up countershafts and appliances for handling machinery. They are having their experience with French workmen—carpenters, etc., and solemnly and unanimously declare that an American workman will do four times as much work in a day as a Frenchman can be induced to do. The congestion on the railway between Havre and Paris has been, and still is, very great. The wharf at Havre and the freight yards between here and there are simply buried in packing cases, and it is declared that though one may know that his machinery has reached Havre, still he finds it impossible to locate it or to find anyone who

can give him any idea whatever of its present whereabouts.

Much machinery that was shipped early has fared no better than that which was shipped later, because there was no place ready to receive it; it laid on the wharf at Havre and, the spring being unusually wet, much of it was pretty thoroughly rusted. The Pratt & Whitney exhibit especially suffered in this way, but seems now scarcely better off within their space at Vincennes, where it stands, cleaned up, but uncovered and fully exposed to the blinding and suffocating blasts of dust and sand that blow through the building, and that have formed a gray coating over all the beautifully scraped and finished surfaces.

Of all the exhibitors at Vincennes the Brown & Sharpe Manufacturing Company is most advanced, its line shaft being up, most of the machines located and the countershafts in place, with belts and motors ready to run. This is partly due to the fact that months ago, as soon as its space was assigned it made plans of the exhibit, showing the exact location of everything, and then got the Berlin Iron Bridge Company to put up the required steel structure for its overhead works at the same time as and with the building. It then made complete in the shops at home all the stringers and everything required, so that here there was nothing to do but put them up according to the blueprints. The company rightly calculated that work done in East Berlin, Conn., and in its own Providence shops would cost far less than if done here, and at best there is enough to do here.

SOME ANNOYANCES.

Of course, a great many annoying things happen in getting such an immense undertaking as this exhibition under way. Action is sometimes taken without thought of its consequences, but what is worse is the apparent impossibility of getting official action where and when it seems urgently needed. As an example of ill considered action, it was found that after the exhibition opened the passes that the workmen employed by exhibitors at Vincennes had been previously using were no longer valid. A special pass had been invented for them, but there was absolutely no notice of it in advance to anyone; simply the workmen went to the gates as usual to go through to go to work and were refused admittance. Those who were not enterprising enough to climb the fence, as some of them were, waited until their employers had applied at the office of the American commission in the city, gotten the new form of passes and taken them up to Vincennes, all of which resulted in the loss of about a day's time, when every hour seems urgently needed.

VISITORS TO VINCENNES.

A question that is being much discussed is as to whether or not visitors in any great numbers will go to Vincennes to see the exhibits there. No tools except American ones will be seen there, the tools from all other countries being in the main exhibition at the Champ de Mars. This cannot but be regrettable, for Americans like to believe that their tools show to advantage when alongside of and contrasted with tools from other countries, and it is expected that there will be more or less of efforts to convince those who might be disposed to go to Vincennes that the trip is scarcely worth while.

But, on the other hand, all the railway exhibits—locomotives, cars, track, signals, etc.—from all countries are near the American machinery building at Vincennes, and all the automobiles and horseless carriages will also be shown in a near-by building. It is argued that these features will bring practically all who are seriously interested in machinery of any kind to Vincennes. Six of the leading tool exhibitors at Vincennes are arranging concertedly to employ someone with good command of European languages and acquaintance with machinery to represent them at their small exhibits at the Champ de Mars, and to get hold of such visitors as are really interested in machine tools and induce them to go up to Vincennes. Some such plan would seem to be necessary, for it would be impracticable for each exhibitor to keep a man always on duty at the Champ de Mars in addition to the force employed at Vincennes.

The question of transportation between Champ de Mars and the Vincennes annex is also receiving some attention. One can go by the Seine boats or by cab, omnibus and trolley or steam cars, but considerable time is consumed, and though the Seine boats are numerous, very fast and handled at the various landing places with remarkable rapidity, there is a long walk between the landing station and the Vincennes exhibit, and the boats make too many stops on the way to permit of good time being made. It is said that, later, express boats will run that will make no stops between the two portions of the exhibition, and that some means of rapid transit will be provided where the aforesaid long walk now comes in. If this is done, it will probably be the favorite way of traveling the 4½ miles of intervening distance, and, of course, the success of the Vincennes annex depends largely upon what may be done to give facilities for this travel.

SUNDAY OPENING.

Another live question is that of Sunday opening. Sundays will undoubtedly be the most important days during the exhibition. That is the way of the Continental people. The workmen, foremen, superintendents, draftsmen, etc., of Continental shops, as well as other people, will be here on Sundays in far greater numbers than on any other day. To close the American machinery exhibits on Sundays will, therefore, be to lose the best days of the exposition, and although when at home we prefer to suspend all business on that day, it is a question whether, being in Rome, it is not better to do as Romans do, and conform to the custom of the country. Of course, this will not necessarily involve seven days' labor per week by attendants, because some other day of the week can be taken for rest and recreation.

Paris, April 20. F. J. M.

The Rice Bevel Gear Cutting Machine.

We show herewith a bevel-gear cutting machine—the invention and design of C. D. Rice, of Hartford, Conn.—which is based upon an entirely new principle. Mr. Rice is master mechanic of the American Bicycle Company, Columbia factory, and the machine was originally designed for making bicycle gears, and it has made many thousands of them. The machine here shown is the latest design, and contains many improvements over the original.

The machine, broadly speaking, is of the template type, as it does not generate

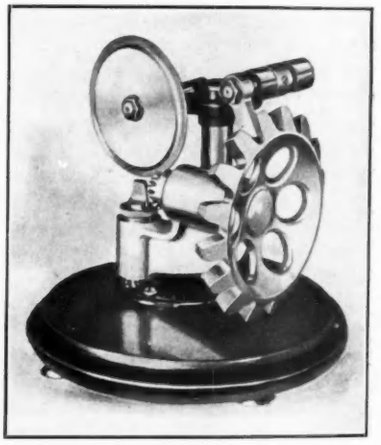


FIG. 1. MODEL SHOWING PRINCIPLE OF ACTION.

its curves, but reproduces those with which it is supplied, though, of course, on a reduced scale. The template is not, however, laid out or constructed by hand; but is itself a complete master gear, those in use up to the present time having been made by Mr. Bilgram on his well-known generating machine, so that the resulting tooth curves produced by the machine are in reality generated curves. George B. Grant, in an article published in our issue of December 3, 1896, gave as his opinion that "a Bilgram planed tooth is generally the most nearly perfect thing about the machine on which it is used," and as the master, or template, gear is of about five times the dimensions of the gear made from it by this machine, the errors in the gears made are correspondingly reduced from that of the master.

The principle of the machine is best shown in the model, Fig. 1, which has been made for this purpose. The large master gear will be seen at the right,

mounted upon the outer end of a horizontal axis, and the gear to be made (already gashed) is upon the inner end of the same axis. This axis is mounted upon a swinging arm, which may oscillate about a vertical axis. The cutter—represented by a large disk—is mounted upon a second but fixed horizontal axis, and is represented as having entered one of the gashes. A fixed stop, called the guide plate, enters a space between the teeth of the master gear. The acting face of the guide plate is in a true plane with the acting face of the cutter, and this plane contains the apex of the pitch cone and the axis of the vertical shaft. It is plain that if the tooth of the master gear be held in contact with the guide plate, and if while in such contact the swinging arm be swung bodily from the observer, both master gear and the gear to be cut will have a double motion, combined of the swinging motion of the arm and a turning motion about their own axis, and during this motion the cutter will obviously reproduce on the blank, and upon a reduced scale, the curves of the master gear tooth. Stepping from tooth to tooth, one side of all teeth is soon completed, when the cutter must be adjusted parallel with its axis an amount equal to its own thickness, and the guide plate must be correspondingly adjusted an amount equal to its thickness, when the opposite sides of the teeth may be cut by the reverse motion of the swinging arm. Since the cutter does not travel lengthwise of the tooth being cut, the resulting space is, of course, cut slightly deeper at its center than at its ends. To reduce this to an unobjectionable amount, the cutter is made large, as shown. It will be understood that the acting face of the cutter being a true plane, the extra depth of the cut has no effect on the acting portion of the tooth curve.

The model also shows a method of testing the accuracy with which the vertical and work spindles meet, either in construction or after use. The vertical spindle is bored lengthwise with a true hole, in which is inserted a plug. This plug is planed down to half its thickness—for a short distance from its upper end, the result of which may be tested with great accuracy through the use of a micrometer—and if a similar plug be inserted in a corresponding hole in the work spindle, with its planed surface facing the opposite way, the two planed faces must make contact. Furthermore, if both plugs be reversed the accuracy is doubly proven. This point proven, the plug in the vertical axis is also used to adjust the cutter face and the guide plate in a true plane, since when in this position a straight-edge must accurately register with all of them. Extreme accuracy in the angle between the two axes is not essential, as the curves of the master gear would be accurately repeated without it, but it is essential that the axes meet with the greatest precision.

Fig. 2 shows the machine built around this simple principle. The master gear, the guide plate, the cutter, the work, and the swinging frame will be readily recognized. The mechanism added is simply that necessary to make the action automatic. An index plate will be seen at the left, but the purpose of this is merely to insure the entering of the guide plate in the master gear spaces as the swinging arm is raised to position for each cut. Once this is accomplished, the index plate is disengaged and the master gear has full sway throughout all cutting operations; that is to say, the master governs the tooth spacing, the tooth thickness and the tooth form, and as all gears have a working mate, it follows that by giving each pair of master gears a practical running test as to smoothness of action, treating them, if necessary, to improve their behavior, passing upon this master practically inspects all work that is to be done from it, as, allowing that the machine is perfectly adjusted under its well established requirements, each specimen of the work must be a duplicate of its master, with the errors reduced in the ratio of their comparative sizes.

The weighted arm which maintains contact between guide plate and master gear tooth will be seen at the left, projecting toward the observer. On it is also a roller, which acts also as a weight, and below it is a curved T arm rising from the standard below. Connecting this standard with the main frame casting is a frame member, within which is a revolving cam shaft. A cam on this shaft, directly below the vertical spindle of the swinging arm, lifts and drops this spindle, the swinging frame and the parts which it carries. A cam on the outer end of the same shaft lifts and drops the T arm, and another alongside attends to the indexing movement. After the indexing movement, the swinging arm first rises rapidly and carries the blank nearly to position for correct depth of tooth space, when the mo-

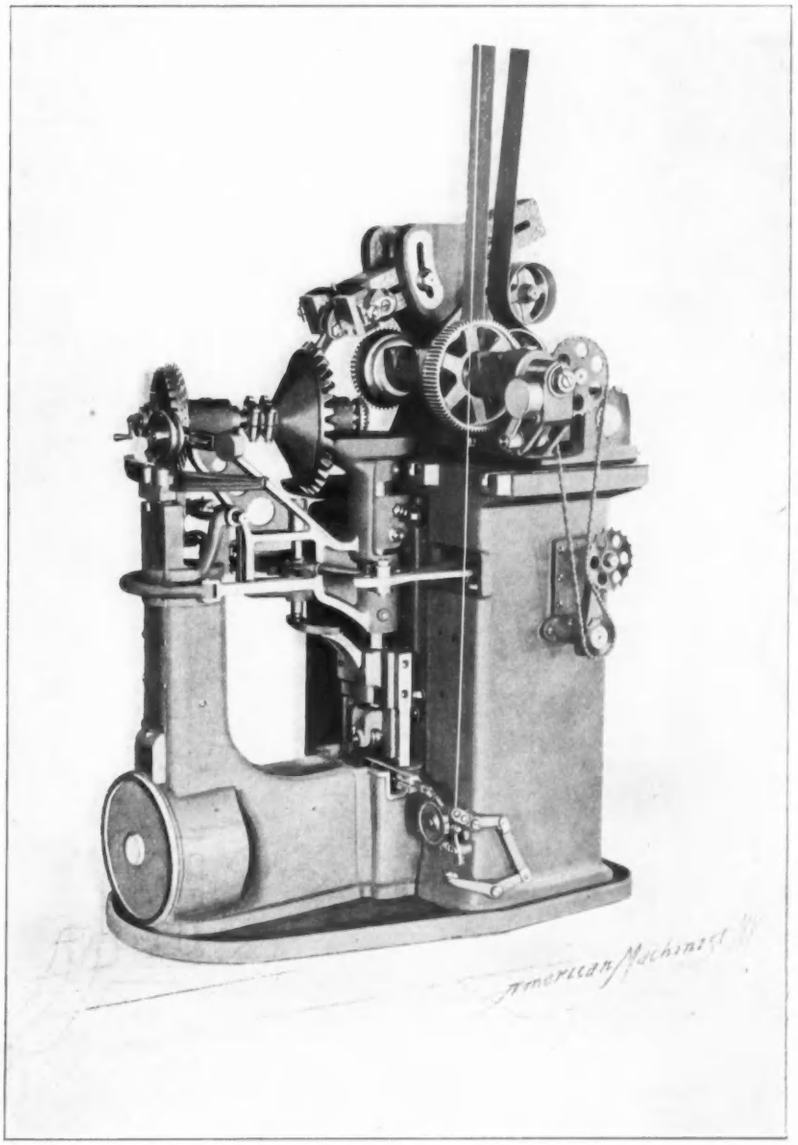


FIG. 2. THE RICE BEVEL GEAR CUTTING MACHINE.

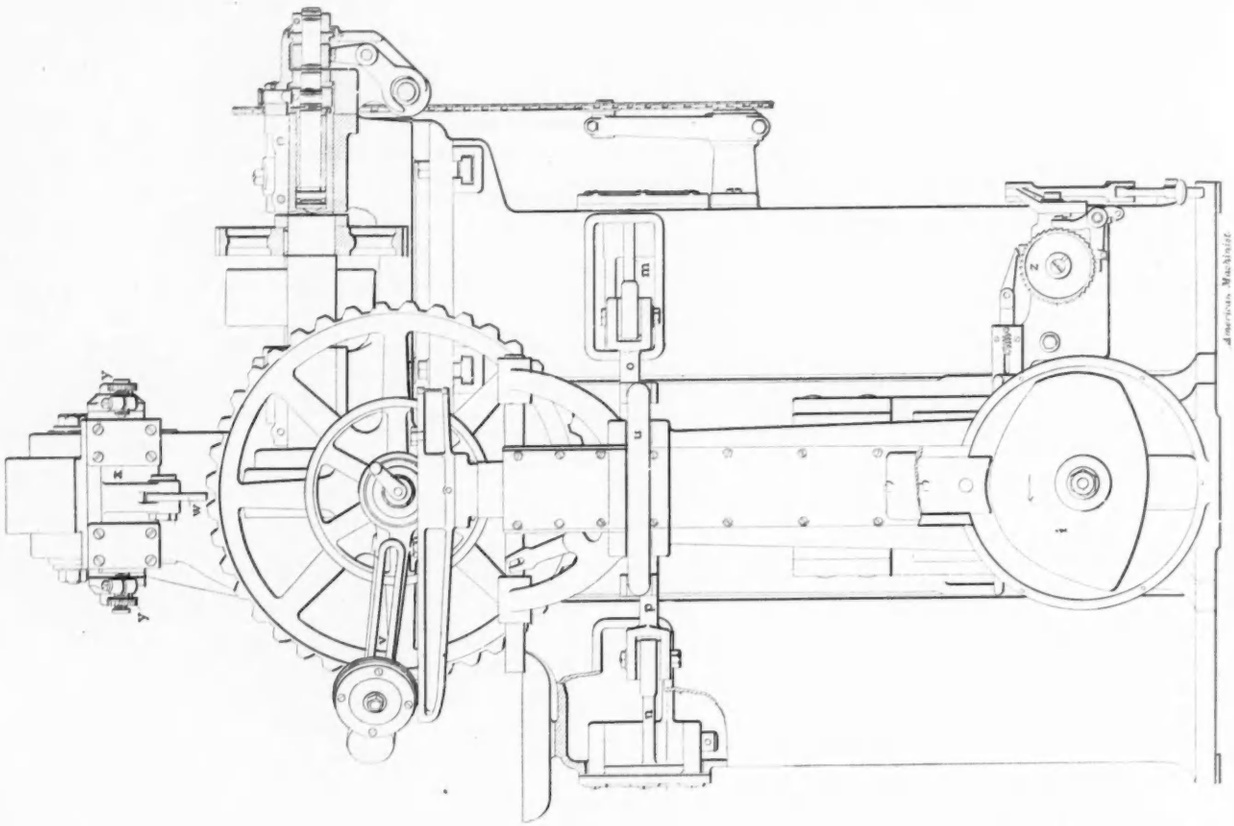


Fig. 4
FRONT ELEVATION.

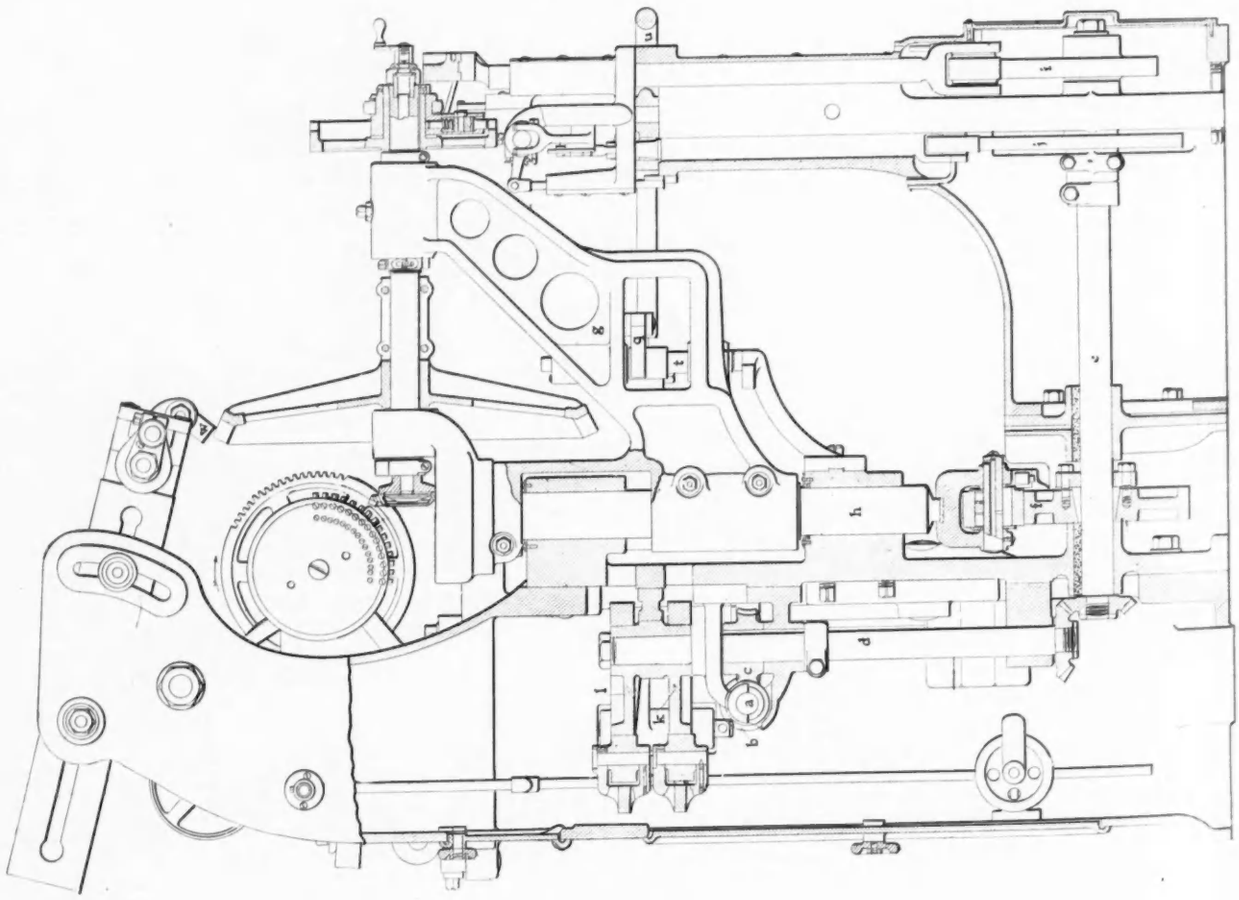


Fig. 3
TRANSVERSE SECTION.

tion slows down to a feeding motion, which carries the blank to correct depthing position. During the operation of cutting to depth the T arm ceases to rise, which causes a slight rotative movement to the work spindle on account of the swinging arm continuing its lift during this depth feed cut, so that when the cutters have reached the bottom of the cut the side-wise action has been sufficient to insure contact between the guide plate and the master teeth. The downward movement of the T arm therefore gives the controlling weight full sway during the development of the tooth curve, causing the master gear to turn until stopped by the guide plate, and the swinging motion sets in—the weighted arm insuring constant contact between master gear and guide plate. The cut completed, the swinging arm reverses its motion. During this motion the weighted arm could readily be lifted by the guide plate acting on the master gear tooth, but this might cause unnecessary wear, and by a precautionary refinement the T arm is lifted rapidly enough to engage the roller weight and relieve the master gear tooth from the pressure of the guide plate during the return motion.

Reference to Fig. 2 will show a pitch chain for driving a sprocket wheel on the side of the main frame. This sprocket wheel drives shaft *a*, Fig. 3, which through worm *b* and worm wheel *c* drives the vertical shaft *d*. Through the bevel gears below, shaft *d* drives, in turn, shaft *e*, on which cam *f* elevates the swinging frame *g* through the vertical spindle *h*. As the parts to be handled by cam *f* are quite heavy, the cam roller is fitted with a roller bearing, which has proven very satisfactory. At the opposite end of shaft *e* cam *i* operates the T arm and cam *j* operates the indexing mechanism. At *k l*, on the vertical shaft *d*, are two cams which operate the triangular levers *m n* of Fig. 5. Each of these levers connects with a link *o p* at its outer end, these links having jaws *q r* which engage with a block *s* surrounding the pin *t*, which is located in the swinging frame *g*. The action of these connections is obviously to accomplish the swinging motion. The connections upon one side accomplish the motion for one side of the teeth, and those upon the other for the opposite side. After completing one side of all the teeth, the machine automatically stops and the attendant reverses this connection through the segmental hand wheel *u*, which is so connected to the jaw ends as to disengage one jaw and engage the other by the same movement.

At this reversal the weighted swinging arm *v*, Fig. 4, is also swung over to the opposite side by the attendant, and the guide plate and cutter head are shifted by an amount equal to their own thickness, as has already been stated, these latter changes being also made by hand. Reference to Fig. 4 will show that the guide plate *w* is mounted on a block *x*, which may freely slide endwise between the micrometer stop screws *y y*. These screws being adjusted to permit a movement equal to the thickness of the guide plate, the pressure of the master gear teeth accomplishes the movement.

The starting and stopping mechanism consists of a simple disk or ratchet *z*, Fig. 4, having as many notches as there are teeth in the work, there being a trip or release pin at a certain point in this ratchet which will release the engagement and thereby allow the overhead spring connected with the countershaft to disengage the friction clutch pulley when the circle is completed. As the machine is universal as to angle and pitch, as well as diameter, it is simply necessary, when an increased amount of stock is to be removed in coarser pitches, to slow down the cam movement, and yet permit the cutters to maintain their same speed ratio. This is readily accomplished by placing sprockets of varying dimensions on the worm shaft *a*, Fig. 3, the looseness of the chain due to these changes being cared for by an idler which swings over the bearing which carries this shaft.

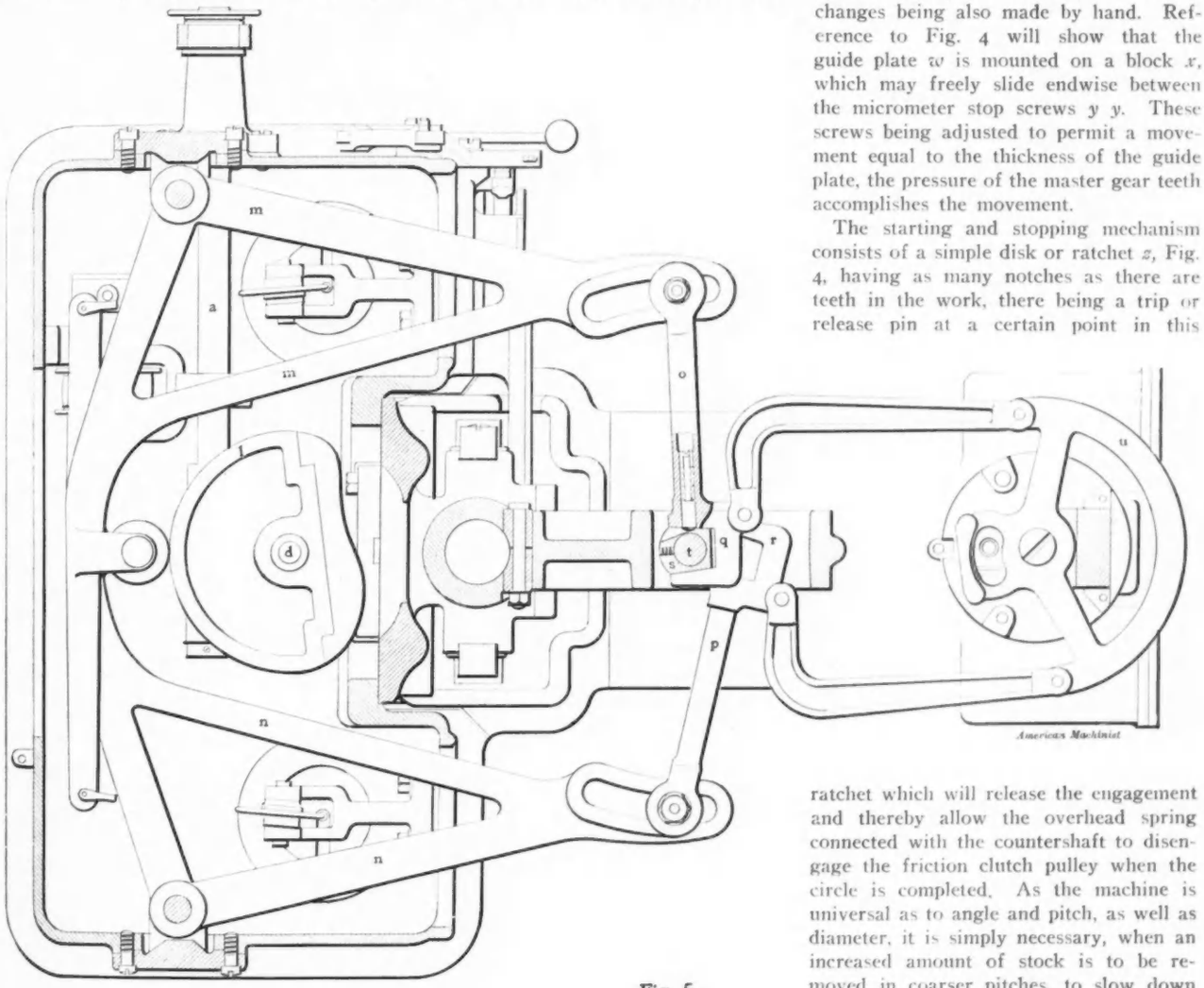


Fig. 5
SECTIONAL PLAN.

THE CUTTERS AND THEIR MANUFACTURE.

It is of obvious importance that the cutter head be made with a high degree of accuracy. It is of large diameter (8 inches for bicycle gears), and has inserted teeth. Unless made with a high degree of accuracy their parallel faces, which develop the tooth curves, could not carry in the

same plane while rotating. The cutters are not adjustable in their holdings. The methods used in making the cutter teeth form an excellent illustration of refined methods of doing precision interchangeable work. Fig. 6 shows the cutter head complete. The spindle is, of course, ground, and the plain hardened and ground disk which seats against the spindle shoulder serves to control the position of the cutters in every way except that of spacing them, which is done by the outer or binding disk, which carries the binding screws. As accurate spacing would not improve the quality of the work, the binding disk is not ground after hardening. The teeth shanks being first cut with a slight excess of length, they are then planed on three sides—the side against which the clamping screws rest being left unfinished. The blanks are then dropped into the milling fixture shown in Fig. 7, which receives the tool about five degrees from a perpendicular line, and by using a cutter set between the straddle mills, the blades are not only size-milled to grinding thickness, but the over-all grinding length of the tool is also established, as each tool rests at its lower end on a seat within the fixture. In doing this operation slight allowances are made for the final grinding of all cutting surfaces. This fixture is also made so as to swivel in either direction, say, three degrees, more or less, so that by removing one of the straddle mills the teeth can be backed off on their sides, first by swiveling in one direction and then in the other, thereby reducing the grinding to a minimum. The tools are then hardened, care being used to heat to a point just back of the teeth only, so as to prevent shank warpage. The cutting face of the tool throughout its entire length is then placed against a fine face-lap, which not only brightens it, but gives a little higher finish than would the planing, thereby improving its behavior when dealing with chips during its first cutting life.

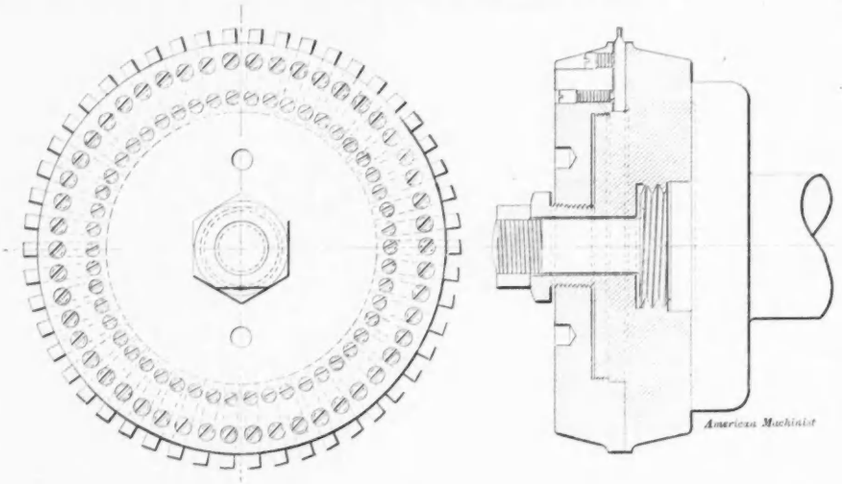


Fig. 6
THE CUTTER HEAD.

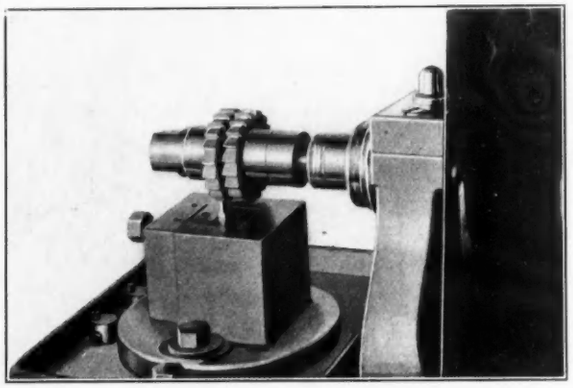


FIG. 7. BLANKING OUT THE CUTTER ENDS.

Fig. 8 shows a complete grinding outfit for the sides of the tools, including a jig which receives the tool in exactly the same manner as does the cutter head used in the gear-cutting machine, care being used that the screws are at the same places, so that all influences upon the tool will be repeatedly the same as nearly as possible. This jig is hardened and ground, bears against hardened and ground surfaces which control its movement, and is carried under hand pressure. After grinding one side it is reversed and fed in the opposite direction in grinding the opposite side. These movements create parallelism on the part of the tool up to and beyond a point which can possibly affect the quality of the work, the emery wheel being narrowed down to a thin and slightly rounded periphery. It is of very large diameter, however, so that by setting the work sufficiently above the horizontal center of the wheel the wheel will at the same time back the cutter off almost in a straight line and closely corresponding with the backing off in the miller, thereby

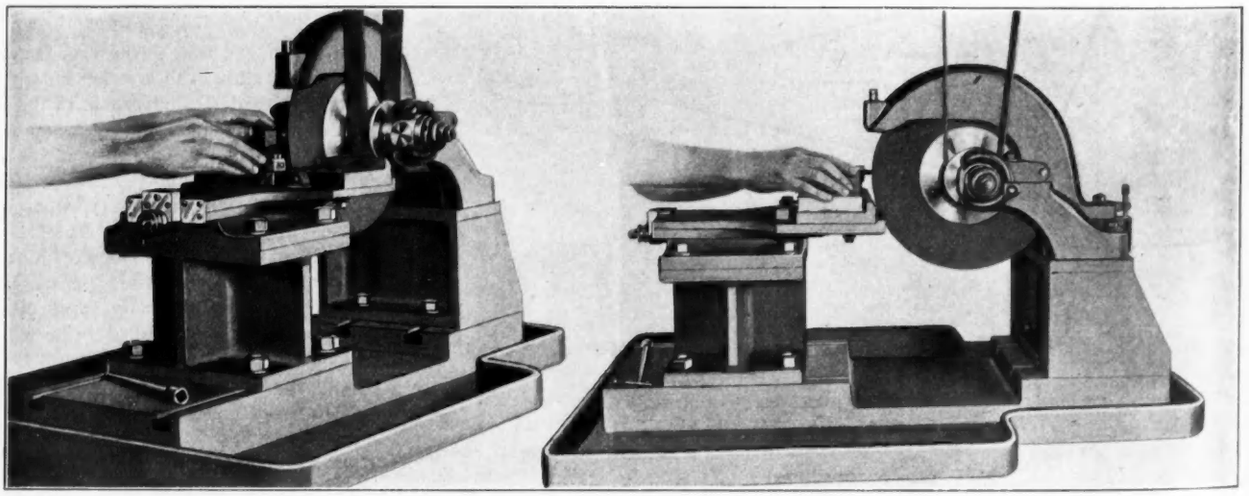


FIG. 8. FIXTURE FOR GRINDING THE SIDES OF THE TEETH.

FIG. 9. GRINDING TO UNIFORM LENGTH.

giving equal cutting clearances. It is necessary that these teeth be kept carefully to thickness in all cases where they are operated together in one set, but in determining this thickness the nature of the jig is such as to always guarantee exact relations between the imaginary center line of the cutting tooth and the controlling face of its shank. Practice has demonstrated that with a large emery wheel and a tooth milled very closely to its finishing thickness it is possible to maintain equal thickness almost with precision, the jig carrying fixture having a graduated micrometer screw which will permit occasional compensation for wheel wear to the finest of measurements.

Fig. 9 shows the same grinding outfit, including the same jig, with the controlling hardened surfaces which guide the jig, so adjusted as to enable it to perfectly establish the extreme outer ends of the teeth so as to insure all tools being of exactly the same length in their over-all measurement, this supporting and controlling fixture for the jig being left in the same plane so as to insure proper backing off.

Fig. 10 shows a special oscillating fixture for rounding all corners alike from a common working point, so that each corner will do no more than its share of work, although this particular feature has little to do with the quality of work produced, except that it might compel more frequent grinding should this point not be adhered to.

Fig. 11 shows a micrometer gage, the frame work of which is so formed as to receive one-half cut away bushings, the inner bores of which conform to the circles established at the tool corners, so that by placing each tool in this receiving gage and using a micrometer screw at the rear end of the shank it is easy to determine whether all tools are rounded to the same degree or not.

Fig. 12 shows another grinding jig applied to the same outfit, which serves for resharpening these tools, the rule being to grind the cutting face only as is the case with any patent relief formed cutter, except that care is used to see that all tools are ground back so as to measure the same as to depth, so that what little is accomplished in the way of reducing their thickness by this process will be the same with all tools in the same set, the gear-cutting machine having a graduated controller which will compensate for this tooth reduction. It is the intention, as soon as experience may enable this to be done, to establish a rule for grinding back so many thousandths at each grinding, so that should a tool break through accident tools of this standardized type and limit, having the same amount ground from their faces, will be on hand to be used as substitutes in their respective classes, thereby preventing any delay in operating the gear-cutting machines.

Fig. 13 shows the surface plate test, using a micrometer depth gage to determine the accuracy with which the tools are placed in the cutter head before placing in the machine.

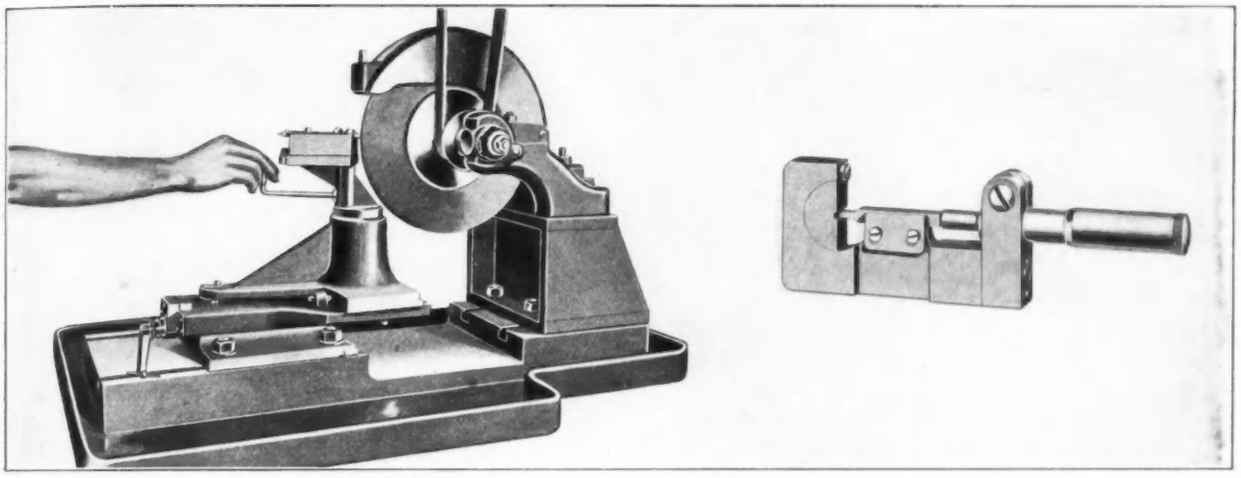


FIG. 10. ROUNDING THE TOOTH CORNERS.

FIG. 11. MICROMETER GAGE FOR LENGTH OF TOOTH.

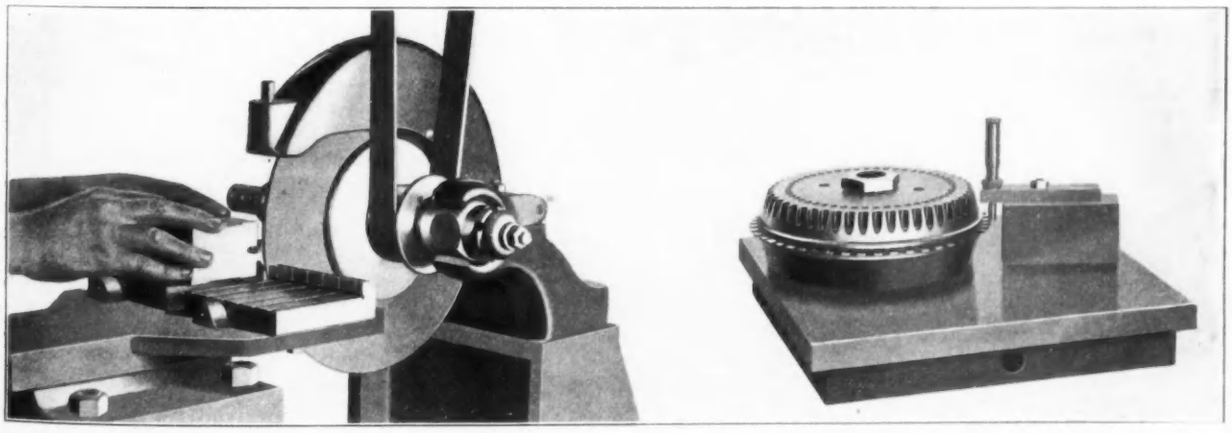


FIG. 12. RIG FOR SHARPENING THE CUTTERS.

FIG. 13. MICROMETER GAGE FOR TESTING ACCURACY OF CUTTER HEAD.

To those accustomed to other methods these may appear to be uselessly, or even extravagantly, refined, but in point of fact it is believed that the cutters are made more cheaply in this way than they could be in any other, and in fact these methods are considered the key to the success of the whole system.

A calculation regarding the actual

amount of service seen by each tooth of a cutter head gives the surprising result that for each ten-hour day each tooth actually cuts metal during *thirty-one seconds only*, which would require 116 ten-hour days to make the actual cutting time equal one hour. Considering this short service and the fact that heating is impossible, and thorough lubrication is insured, it is not surprising that the cutters are long lived. The calculation, it should be stated, is based on cutting teeth for bicycle gears, which are shorter than those for other purposes.

As stated above, the machine was originated and developed at the Columbia Bicycle Factory, Hartford, Conn., but it is now controlled by the Rice Gear Company, of the same city.

Notes From Manchester—Lessons Taught by War—An English Axle Lathe—Samuel Crompton's House—Some Ideas About American Workmen.

The war in South Africa is at present absorbing a large share of everyone's thoughts here. The lessons so far learned from its course will apparently alter the methods pursued in the preparation for, and conduct of warfare by all civilized (and in some cases uncivilized) powers. The whole situation, in fact, bears a strong resemblance to the world's industrial situation, and points to the need of intelligent appreciation and utilization of all classes of ability, conventional and unconventional, regular and irregular. For instance, the offers of home and colonial contingents of irregular horse were at first almost scornfully ignored by red-tape-bound War Office officials. Now it is intimated they will "accept" the services of 10,000 or more of the class of men at first refused. Each man will be granted an amount for horse and equipment which will not cover their cost within about $100. This body of men will be known as the Imperial Yeomanry, having as its nucleus picked men of the irregular regiments mostly formed about a century ago, when invasion by the French seemed imminent. Manchester will furnish about 120 men to this corps for immediate service at the front. The Manchester volunteers territorially connected with the regular battalions now in South Africa are also providing two or three complete companies of officers and men for actual service along with their regular comrades. They will join the army for one year, or as long as the war lasts, and one of the conditions of their acceptance is that they must be first-class shots with the Lee-Metford rifle.

All the volunteer engineer reserve men from Crewe are now at the front; 300 men, not in the reserve, have also volunteered, and, if accepted, will, like the first named, receive half wages from the railway company while on military duty. The Volunteer Electrical Royal Engineers, an organization formed about two years ago, of which, since the death of Dr. Hopkinson, Lord Kelvin is Honorary Colonel and Major Crompton, of Chelmsford, the well-known electrician, in command, is also contributing its quota. The men will assist the regular engineers in the working of the search-light and allied electrical field apparatus. The Manchester Volunteer Medical Staff Corps is furnishing a company for ambulance work on the field. The large number of reservists called out for duty has had a marked effect on the semi-skilled and "unskilled" labor market. Mr. Gladstone once said that if he could only be the means of making people think, he would feel quite satisfied. The war now in progress will provide numbers of points for consideration, both from employers and employees. Some interesting questions are being dealt with during the present winter session of the Manchester Association of Engineers. Suggestive papers have already been read by Messrs. J. S. Raworth and J. E. Fletcher, on "The Generation and Electrical Distribution of Motive Power" and "Some Difficulties in Steel Castings Manufacture," respectively.

A discussion following a paper read by Mr. A. R. Bellamy on "Engineers' Machine Tools," in which the writer criticised machine tools from the user's point of view, elicited from Mr. Dixon, of Kendall & Gent, that the requirements of government and similar specifications compelled British tool builders in many cases to build a larger line of tools than they would if able to follow their own inclinations entirely. He also pointed out several instances of prominent American firms, who, setting out as specialists, are now in a fair way to rival British firms in the variety of their manufactures.

Replying to a statement by Mr. Bellamy, that sufficient power was not provided in many machine tools, Mr. Spencer pointed out that sufficient power was generally provided for all ordinary purposes, and, if specified, any reasonable amount of power for special purposes would be made available. As a case in point, Mr. Spencer referred to an axle lathe ordered from his firm by the Indian States Railway—mentioned about a year ago in the "American Machinist" as forming a striking contrast with an 8-inch swing lathe built by them, and illustrated in the article. Some time ago I had the pleasure of seeing the lathe at work preparatory to its being shipped, and by the kindness of the firm am now enabled to give illustrations and description of the tool. The lathe, which is of 30-inch swing, is arranged for turning both ends of a railway axle simultaneously, and consists of a strong bed, supported on three standards, the driving with machine cut treble purchase spur gearing being at one end of the bed. The axle is driven by a fast headstock fixed in the middle of the bed, and having large spindle with 12-inch diameter hole through it and Clement's driver at one end. The axle to be operated on is supported at the ends between the centers of tailstocks. The bed carries two strong saddles, one on each side of the headstock, each carrying two compound slide rests. Each saddle has self-acting sliding motion along the bed, worked by an independent screw. The screws are placed between the lathe-bed shears to give a central pull, and each saddle has quick hand traverse by rack and pinion. Each compound slide rest is fitted with an independent screw so arranged that it can be manipulated from the front of the bed. The two front rests are made to swivel for setting to any angle, and for repetition work an adjustable stop is provided, so that the tool can be set to suit the depth of cut required without gaging the diameter. The tailstock on the right is arranged to slide back from the center in order to pass the axles conveniently in or out of the hollow spindle of headstock. Other particulars are as follows: Admits axles up to 10 inches diameter, and between centers 8 feet 6 inches long. The lathe cone has three speeds, the largest diameter being 36 inches and their width 6¼ inches. The driving pulleys are 24x6½ inches, and the total weight of the tool 28,000 pounds. The test specified by the buyer's consulting engineer was, "To reduce a 10-inch diameter steel bar to 8 inches diameter at both ends at the same time, with a tool working back and front at each end, and with a feed traverse of 4 per inch, or ¼ inch per revolution."

Other papers and discussions during the session include "Health in the Workshop," by Mr. J. D. Sutcliffe; "The Future Development of the Steam Engine," by Mr. Alfred Saxon, and, of special interest to the "mechanic," as distinct from the "engineer," "The Tool Room (a) for the Manufacturer (b) for the General Engineer," and on March 10 the following topics will be discussed: "Has Steel Used in Tool-holders any Advantage over a Solid Forged Tool?" "What Are the Relative Merits of Various Kinds of Belts?" and "What Is the Best Method of Testing Lathes for Accuracy?"

At the Manchester Technical School, the machine tool subjects taken by Mr. J. H. Melloy are: "Planing and Milling Machines." Their history, development, construction and limits of application will be discussed in minute detail. The relative advantages of planing and milling will be considered. The shop calculations dealt with are such as are constantly recurring in workshop practice, and are presented in so simple a guide that any workman can follow. Judging from the synopsis of the course of lectures, the subjects of planing and milling machines will be dealt with in as exhaustive a manner as the time at disposal will permit. The complete syllabus

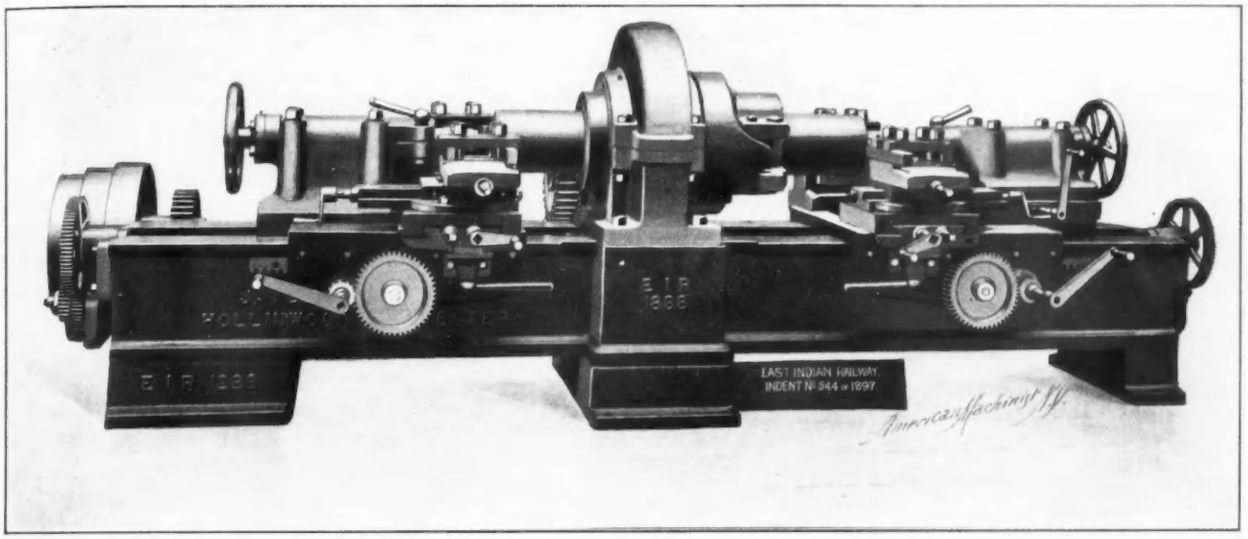
of the Manchester Technical School forms an interesting volume. A most useful subject dealt with is the rendering first aid in case of typical workshop accidents. The lecturer, Mr. J. W. Smith, is a well-known consulting surgeon who has much experience in the hospital treatment of industrial accidents. I note he is going to South Africa as officer in charge of the Manchester Volunteer Ambulance Company.

An interesting memento of an early inventor and his work in Lancashire is, through the public spirit of Mr. W. H. Lever, to be preserved. I refer to the "Hall i'th Wood" (Hall in the Wood), an old Lancashire homestead situate near Bolton, and famous as being the place where Samuel Crompton invented and worked the first "hand mule" for cotton spinning. This building (already at least 500 years old) has been purchased and presented to the town of Bolton by Mr. Lever, who is also restoring the quaint old hall, as nearly as possible to the state it was in when Crompton lived there.

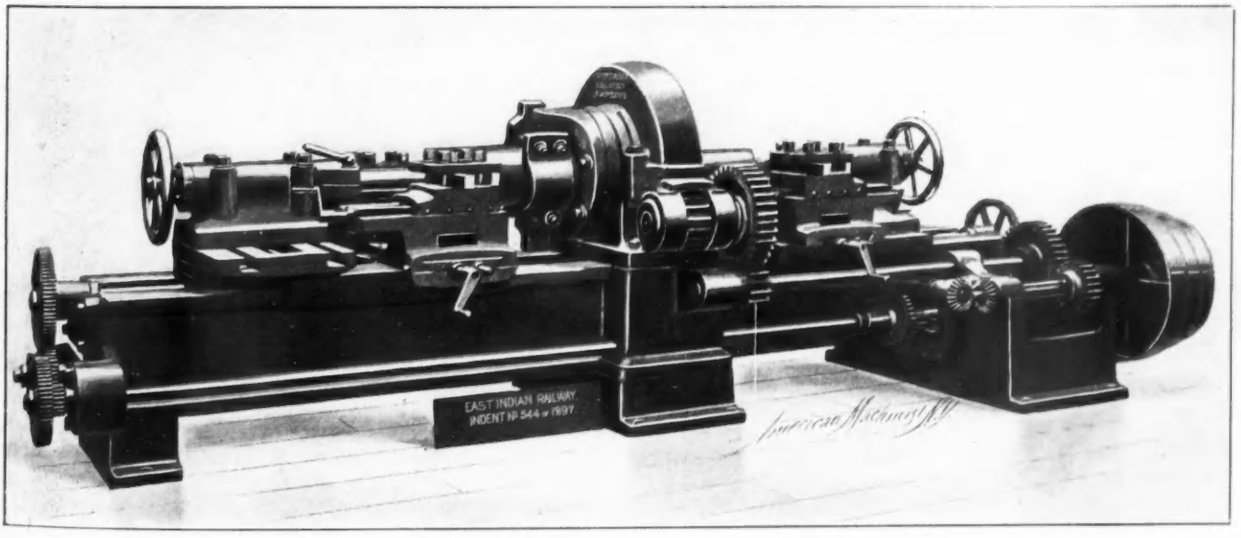
In consequence of the increasing traffic to and from the Manchester Ship Canal Docks, extensive widening and improving of the streets leading to them are in progress. One just completed, and named Whitworth street, as a reminder of Sir Joseph Whitworth's works having formerly occupied a site at the city end of it, has already relieved the congested traffic to a perceptible extent. The subject of street improvement generally is being vigorously dealt with owing to the city's continuous growth, due in a great measure to the success of the Ship Canal, which success, however, has had no detrimental effects on the railways touching Manchester, but the reverse rather, as extensive additions to railway warehouse accommodation have been made during the last year or two. The Midland Railway Company are also erecting a large hotel on the most modern lines, near the Central Station, Manchester.

The City Council will very shortly take over the tramways from the private company now working them, and work them by electric traction. This will add another to the many large undertakings controlled by the Manchester municipality, and will probably cause considerable discussion between the advocates of municipal and private ownership respectively.

The erection, equipment and management of the large works contemplated by the Westinghouse Company at Trafford Park, near the Canal Docks, will be watched with interest by English engineers generally. Typical of the point of view from which some people are regarding it, is the suggestion of one electrical journal, that the proprietors bring over a large



FRONT VIEW OF AN ENGLISH AXLE LATHE.



REAR VIEW OF AXLE LATHE.

number of American workmen, in order to demonstrate how, by the use of "automatic" machinery in American style, ordinary "floor laborers" may be utilized to do the work of skilled mechanics. This publication also advances the extraordinary opinion that it would pay the company to house the men near the works, "as American workmen often do not object to living in a comparative shanty, so long as wages are good and green corn is obtainable." These estimable "organs" are evidently unaware that the American species of "toolmaker" is practically unknown and unappreciated here, and that American firms would at present be pleased if they could increase their own supply, let alone allow any large proportion to emigrate over here. Of course, the idea of specially trained men instructing other less well-informed men is all right, but the idea of tool-producing firms training men at their own expense for the benefit of users of the tools, is not yet adequately appreciated on either side of the pond. I have had the personal pleasure of meeting men of this type representing Brown & Sharpe, Pratt & Whitney, Gisholt Company, etc., and, like many others here, am open to be taught as much as any competent person is willing to teach. These gentlemen have generally seen much to appreciate here, and consider the percentage of progressive and non-progressive firms and workmen pretty much the same in England and America.

JAMES VOSE.

Manchester, England.

An Outfit for the Manufacture of Large Segmental Flywheels.

The large number of segmental flywheels constructed at the works of the E. P. Allis Company, of Milwaukee, Wis., has necessitated the provision of special facilities for the work, and by the courtesy of that company we are enabled to present herewith half-tone illustrations of the outfit used, which is, we believe, unique.

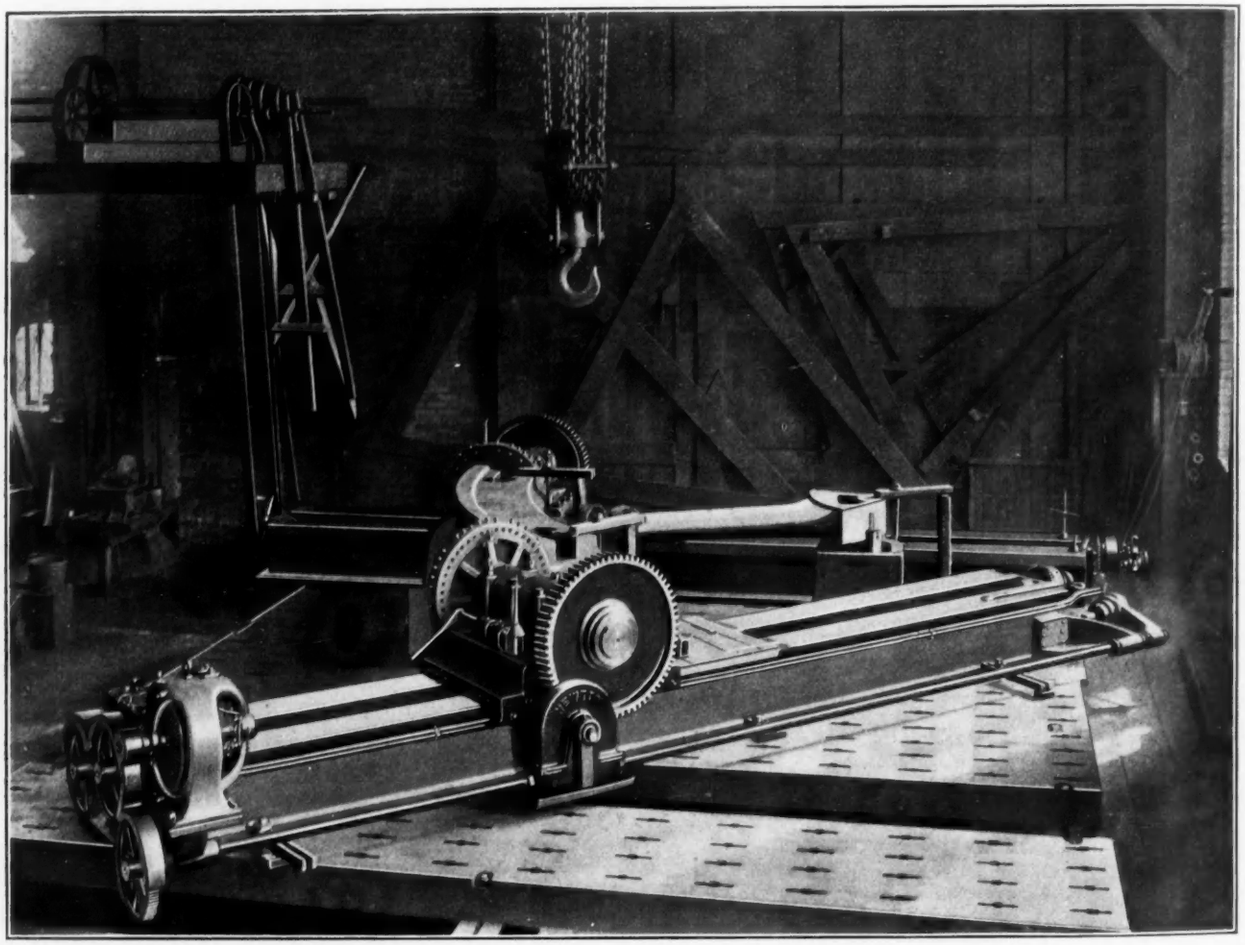


FIG. 1. MILLING THE RIM JOINTS.

The first operation is the face milling of the joints of the segments which is shown in Fig. 1. A large floor plate is provided, to which are bolted two rotary planers. The one in the background is fixed in position, but the one in the foreground is movable. The floor plate has scribed upon it permanent lines which give the positions at which it is necessary to set the movable planer in order to mill the joints at the correct angles for wheels of any required number of segments. The corresponding edge of the bottom flange of the planer frame is planed, and by adjusting the planer until this edge registers with the proper line, the angle is obtained quickly and correctly. The templates hanging on the wall are for the purpose of locating the casting in such a position as to give correct and uniform diameters to the segments. The casting is accurately leveled by lines scribed upon it and a surface gage applied to the floor plate. At this setting the joint is made at both the rim and the edges of the end which enters the hub.

The second operation is the milling of the sides of the end entering the hub, and it is shown in Fig. 2. The planers are adjusted in parallel position and at approximately the distance apart to give the required thickness to the work—the exact distance being obtained by adjusting the cutter heads. The segment is then laid upon parallel strips to bring it to the required hight for the tools. The joints being already square and the strips parallel, the piece takes a vertical position of itself, while the sidewise position is easily obtained by locating the scribed lines central with the planer frames. A very convenient yoke casting will be seen for bolting down the segment and permitting its

easy placing and withdrawal. The fixed planer is belt driven from a countershaft, while the movable planer is electrically driven.

Fig. 3 shows the segments assembled in their hub and having their bolt holes drilled and reamed. On a central fixed base a column is erected on which is a double-arm radial drill press. Each arm carries a drill spindle, and the drilling and reaming of the hub bolt holes are obviously done in the most expeditious manner.

The wheel shown in Fig. 3 tells an interesting story of itself. It is for one of the eleven engines of the new power house

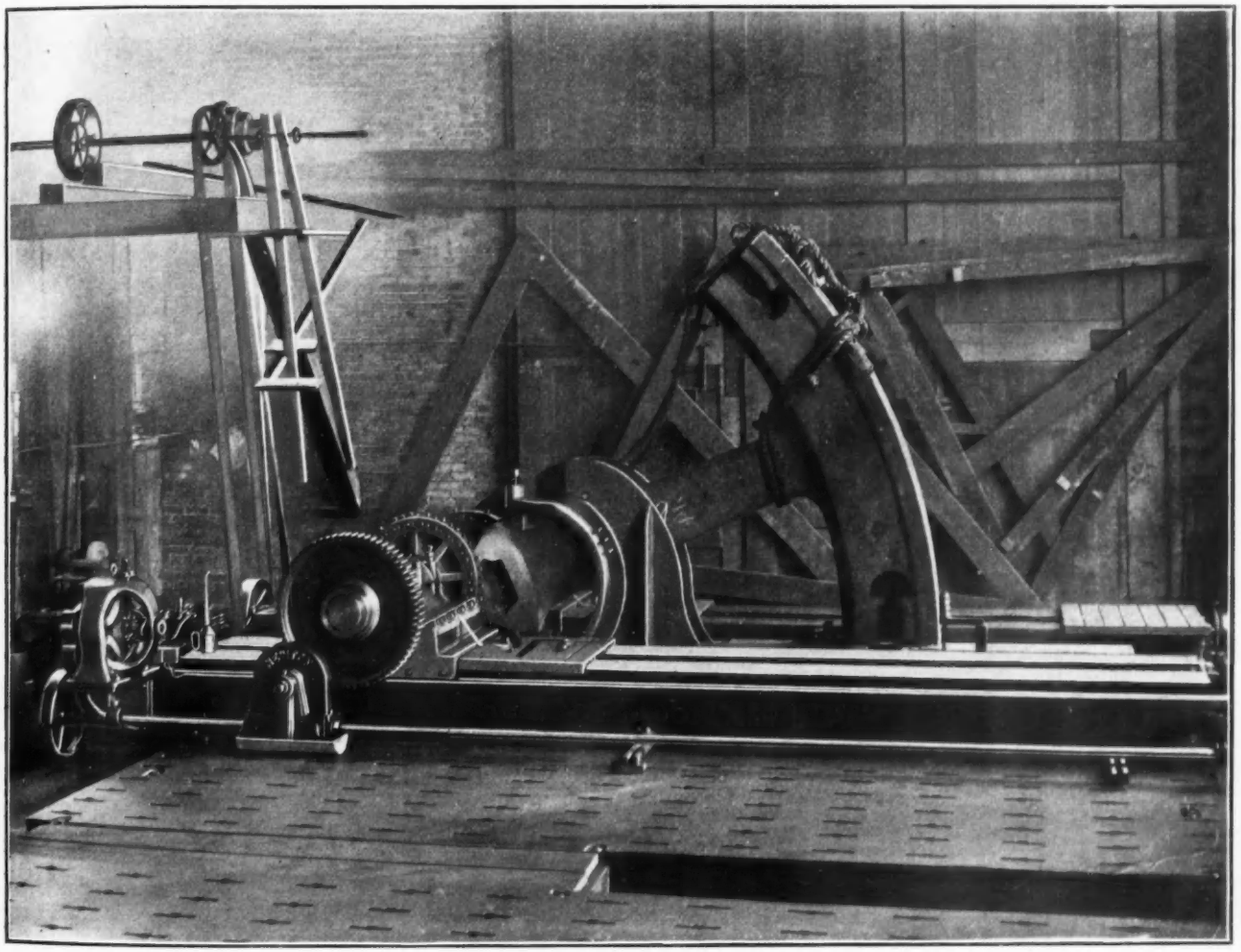


FIG. 2. MILLING THE HUB ENDS.

of the Metropolitan Street Railway Company of this city. It will be seen to be of steel, with shrunk-in links at the joints. These links are not, however, to be the only fastenings. Eight layers of 1⅛ inch steel plates, breaking joints with the segments, and with each other, are to be laid upon each side of the rim and secured by steel rivets, for which the smaller drilling outfit at the right is making holes.

We expect to publish working drawings of this wheel in the near future.

The importance of such an outfit to these works will be realized when we say that a segmental wheel is completed there every other day as an average.

Purchasing Under Specifications.*

The organization necessary to operate a railroad brings together a large number of persons, each possessing varied capacities, and the best results follow where the several talents are fitted into each other, as the wheels of the clock, each doing his best for the result of the whole, and each realizing the usefulness of the others.

The departmental lines should never be so rigidly drawn as to occasion a decrease in the net results of the railroad's operation; and it particularly devolves upon the one to whom is assigned the purchasing of the varied lines of materials required in operating and maintaining a railroad, that he shall adapt himself to the entire railroad and become a part of all departments, show no partiality to any, and belong wholly to no one branch of the service.

The heads of each department should consider the purchaser as a part of that particular department, and the two, with the other officials, work for the sole object of an increase in the sum to be placed to the credit of profit and loss account at the end of the year.

The value of materials and supplies purchased annually by the railroad forms a goodly proportion of the cost of yearly operation. The first cost of any article is not the sole basis of that article's value. Price is but one component part in the determination of values, therefore care needs be exercised in the preparation of specifications covering that which is to be purchased, that they are not so worded as to cut out legitimate competition in your purchases. To make your requisitions of purchase call for so many boiler tubes of some particular copyrighted brand, or for so many pieces of boiler plate of some special manufacture, or for so many bars of some particular brand of staybolt iron, or for so many dozen of some particular make of track shovels, etc., etc., is not to provide your buyer with specifications, but tends only to annul the sole intent and purpose of the office of purchasing agent.

The specifications should be such as to clearly place before the several manufacturers the results to be accomplished, and the accomplishment of which it is your intent to hold them accountable for, rather than to have the specifications so drawn that the purchase price is the principal thing affected, and that in an upward direction. It is either the misfortune or good forture of your speaker to have had several years' experience, both as a pur-

* From a paper by Ira C. Hubbell read before the Western Railway Club, Chicago.

chaser and as a seller, and in the latter capacity he has frequently "gone up against" a phase of the "specification argument" that is quite familiar to many of the members of this body, and where the specifications were so worded that the speaker's bid could not be entertained because his articles did not have quite the proper ingredients in quite the proper proportion.

One of our members not long ago, very courteously referred to a letter your speaker had addressed him, upon the question of the specifications for air-brake hose used upon the line with which the speaker is connected—and more or less discussion followed in one of the railroad papers. The writer's experience, from that date to this, fully justifies the position he assumed in these discussions, and he still continues to purchase air-brake hose upon the broad specifications of a guaranteed service. Experience has taught the requirements of a hose capable of resisting a specified pressure, and that in average service should yield certain results; what more do you want of a reputable manufacturer than his guarantee of that result in service?

Broadly speaking, this should be the sole aim of all specifications, namely, guaranteed service. Let the several heads of departments recognize the fact that, as they are unquestionably much better fitted to have charge of the work assigned them, so is it possible that the man doing the buying may perhaps be a better trader than they, and the better fitted for his particular duties. Mix these two good things together and so get the full capacity of both wheels of the clock—and don't handicap your buyer with specifications that some interested person may have helped suggest; and when the purchasing agent asks for prices, the purchasing agent gets the "cold laugh, ha! ha!" and "I'm specified."

Specifications can always be so drawn that they will secure the service desired, and, at the same time, not shut out competition from any reputable manufacturer, and therefore secure to the road the one result that should always be sought, viz.: the best value for each dollar invested, with the necessary attendant reduction in the operating expenses.

Buying is fully as much an art as is any other branch of the railroad service, and the buyer should be selected with as much care as to his fitness for the place as is the apparent intent in engaging the services of the president. It requires more than one man to run a railroad, or there would never be but the one man on a railroad; but, as before stated, the several officials and subordinates must unite in the one grand aim of increasing the sum placed annually to the credit of profit and loss account, or the railroad cannot continue to exist, and no branch of the railway operation offers a better field for saving than that which can be accomplished by taking the buyer into your confidence in all departments of the service, and securing his co-operation in the preparation of all specifications, and, subsequently, by keeping him fully advised as to the practical results obtained from using the things bought, remembering that the lowest priced article is not necessarily the best value, neither is the highest priced article by any manner of means always the best to purchase, and strive to each keep in touch with the other.

While not entirely germane to the subject, your speaker begs to suggest that it will be conducive to the economical operation of the railroad if the heads of the sev-

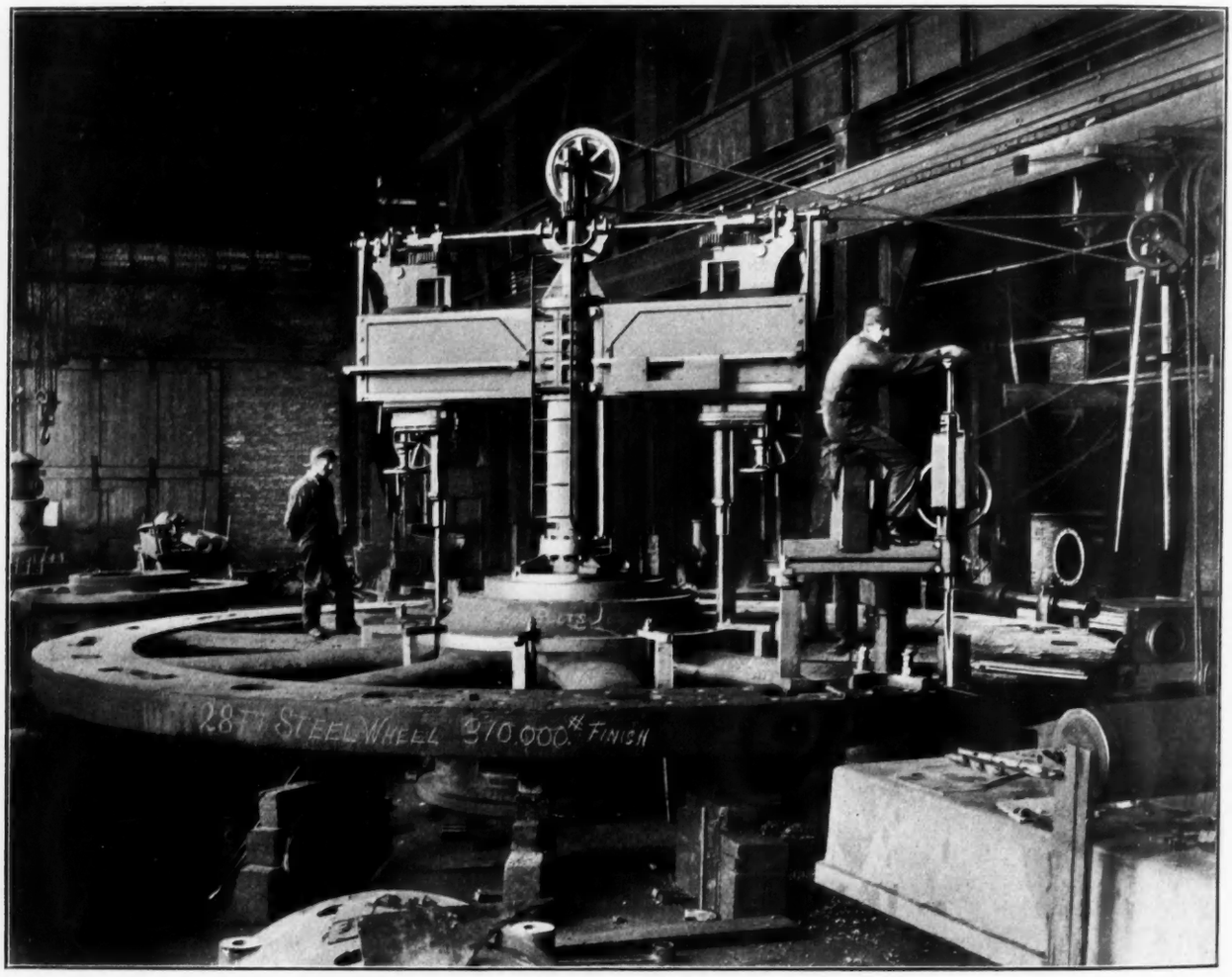


FIG. 3. DRILLING AND REAMING THE BOLT HOLES.

eral departments will consult freely with the purchasing agent in the matter of ordering various articles for trial purposes, and provide for the purchasing agent making the necessary purchase order for the articles for trial, and so arrange that all reports with regard to the performance of the trial material shall be issued through the purchasing agent's office.

It is far from the speaker's desire to undertake to create the impression that the purchasing agent's office is the one central pivot around which, or upon which, the entire railroad organization rotates, but from past experiences gathered from a rather active experience both as a seller and a buyer, your speaker is confident that the observance of the spirit of what has been said upon the subject of "Purchasing Under Specifications" will conduce to a material reduction in the operating expenses of the road.

Dust Suction for a Grinding Room.

The half-tone herewith may be taken as an object-lesson for those whom it may concern. It certainly is not necessary for us to say that, in connection with the use of emery wheels for dry grinding, it is very desirable to remove the dust as effectively as possible, both for general cleanliness and facility in handling the work and for the health and longevity of the employees. It pays to do it, and it is criminal not to do it, and yet proper provision is not always made for this, especially where only one or two wheels are used, and we not long ago looked into a grinding room in which about a dozen men were constantly employed and where absolutely no provision had been made for taking away the dust. For the protection of the machinery of the establishment the room was carefully shut off from the rest of the establishment, but the men were put right into it.

The arrangement shown is very effective and satisfactory. It is on the fifth floor of the F. N. Du Bois manufactory of plumbers' supplies, in this city, and was installed under the direction of the proprietor. The large horizontal sheet iron pipe, nearly one-half of which is shown in the picture, is connected at the middle of it with a large suction fan which discharges above the roof of the building. The upright pipes come down behind each pair of wheels, and at each side of each pipe is the movable spout with its opening right under the wheel. A large opening is provided between the spout and the upright pipe. The central bolt seen at the side of the spout gives friction enough to sustain the weight of the spout, so that it may be moved up or down according to the diameter of the wheel in use. In the progress of the work these are frequently changed, as is suggested by the wheels seen on the floor. The dust is removed from the upright pipes at the slides near the bottom. When any wheel is not in use, a pad is dropped into the opening in the spout, so that the others may have the benefit of as much suction as possible.

The wrought-iron straps fastened to the floor, extending upwards about 2 feet and then horizontally to the wall, are used as supports of the grinding frame which carries the wheels. This pair of wheels had caused an inconvenient jarring of the floor, which disappeared entirely when they were thus mounted.

The New Four-Spindle Drill—Rate at Which a 3-inch Hole can be Drilled.

"Referring to your issue of March 1, page 30, it is stated that a drilling machine built by the Bickford Drill & Tool Company, Cincinnati, Ohio, for the Westinghouse Machine Company is capable of drilling simultaneously four 3-inch holes through 12 inches of solid steel in 12 minutes. That seems to be clearly impossible. I have done a great deal of heavy drilling with a powerful machine and a first-class drill, with a feed that was all the tool would stand, and using the best lard oil, the fastest time I could make was from 3½ to 4 hours, depending on the hardness of the metal. I do not think the work could be done much quicker, for the reason that the friction of so large a drill is so great and the resistance so dense a metal as steel offers to a cutting tool, makes it impossible to reduce the time much below my own experience. I think better results could be gained by using a 1¼ drill and counterboring with a bar and double end cutter. R. E. EVANS.

"Brooklyn."

Our statement was based upon information given us by the Bickford Company, and consequently we referred the above letter to them for consideration, and under date of March 20 they write us:

"In regard to the rate of feed on the multiple drill illustrated in your issue of March 1, would say that as we have no formal record of the test made at our works, we have to-day written the Westinghouse Machine Company, requesting them to give us a report showing the rate of speed they have found most efficacious for their work, which information we shall be glad to furnish you as soon as received.

"All that we can be sure of at this writing is that the machine was tested with four 2½-inch drills working in steel under a feed of .0166 inch per revolution of spindles. Figuring on a periphery speed of 30 feet per minute, we have as the speed for a 2½-inch drill 46 revolutions per minute, which, multiplied by .0166, gives .7636 as the depth of hole that may be drilled in one minute. This is .2364 inch short of 1 inch, but as the machine showed no sign of stalling with a belt one-half the width intended to be used in actual practice, it was thought by those present at the trial that the machine was easily capable of pulling 3-inch drills with a feed of 1 inch per minute—an opinion in which we think you will be slow to disagree after you shall have examined the chip which we are sending you under separate cover in even mail.

"The T. & B. Company, Danbury, Conn., give 57 revolutions per minute as a suitable speed for a 2-inch drill working in steel. This is equivalent to a periphery speed of 30 feet per minute. Figured on this basis, a 3-inch drill should run at 38 revolutions per minute; 38 revolutions per minute is 2,280 revolutions per hour, or 7,980 revolutions in 3½ hours—the minimum time given by your corres-

DUST SUCTION FOR A GRINDING ROOM.

pondent as required to drill a 3-inch hole through 12 inches of solid steel. At this rate the drill would advance only .0015 per revolution, or .0035 slower than we all know is required for a ¼-inch drill. It would seem, therefore, that while we may have possibly made a mistake of nearly 25 per cent. in timing the work, your correspondent's error is from 13 to 15 times greater. In other words, we were 3 minutes too fast, while your correspondent is from 3¼ to 3¾ hours too slow.

"The letter states, however, that the machine was tested under a speed of only 18 revolutions per minute, at which rate it could not have fed faster than .2988 inch per minute, requiring 40 minutes to drill through 12 inches of metal.

"In our judgment the whole question rests upon the speed at which a 2½-inch drill may be run. We are satisfied that a feed of .0165 inch per revolution of spindle is none too fast for a tool of this character. Hence, even though the speed be reduced to 24 revolutions per minute, it would take but 30 minutes to drill through 12 inches of metal, or one-seventh the time given by your correspondent."

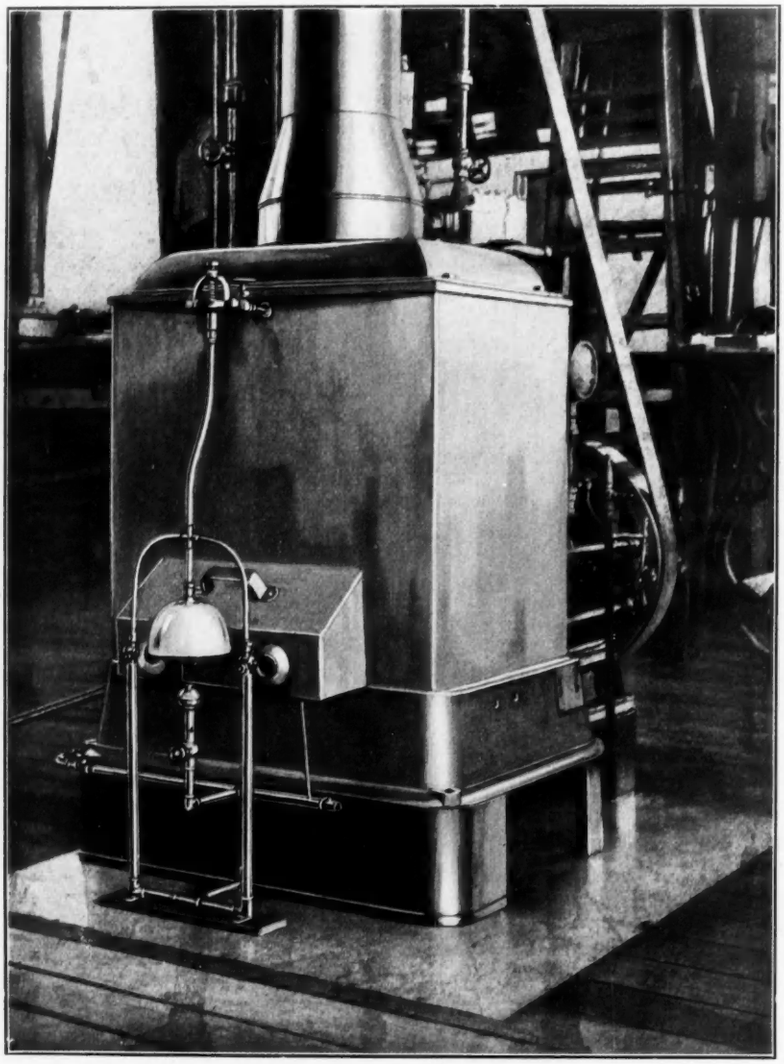


FIG. 1. A STEAM ATOMIZING AUXILIARY BOILER.

"It might be well to state, in this connection, that the drilling on this tool is done under a heavy stream of oil, which, of course, permits a much higher rate of speed and feed than could otherwise be used."

Under date of March 27 they wrote further, as follows:

"We are in receipt of a letter from the Westinghouse Machine Company, in which it says that the portion of the shop in which the new drill sits is not yet floored over, and that it has not, therefore, yet been assigned any regular work.

A Steam Atomizing Auxiliary Boiler.

BY R. I. CLEGG.

We have had a 5 horse-power steam engine and boiler of the oil-fuel type at the factory. It worked satisfactorily for a time and the outfit seemed perfectly suited to the "long-felt want" previously existing. The little plant was claimed to be thoroughly automatic in operation, and, provided with the necessary fuel and water, capable of being left to its own sweet will and accord for an indefinite period. Possibly "sweet will" ought not to be addressed to an oil-burning arrangement, anyway; but, no matter, I think the whole trouble started with the first improvement, or addition, we made to the machine.

It looked better to have a light near the steam gage, so we decided on a gas burner at that place. Then we had had kerosene torches at the mouth of the furnaces to insure the ignition of the oil and steam spray, and naturally we thought that two more burners would be little additional trouble, and so we decided on placing gas fixtures instead of the oil torches. These changes suggested a still further use of gas, and Mr. Cross devised the donkey

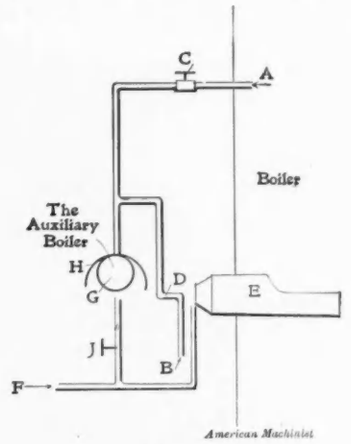


Fig. 2

AN ATOMIZING BOILER.

boiler shown in the half-tone, Fig. 1, and in diagrammatic style in Fig. 2.

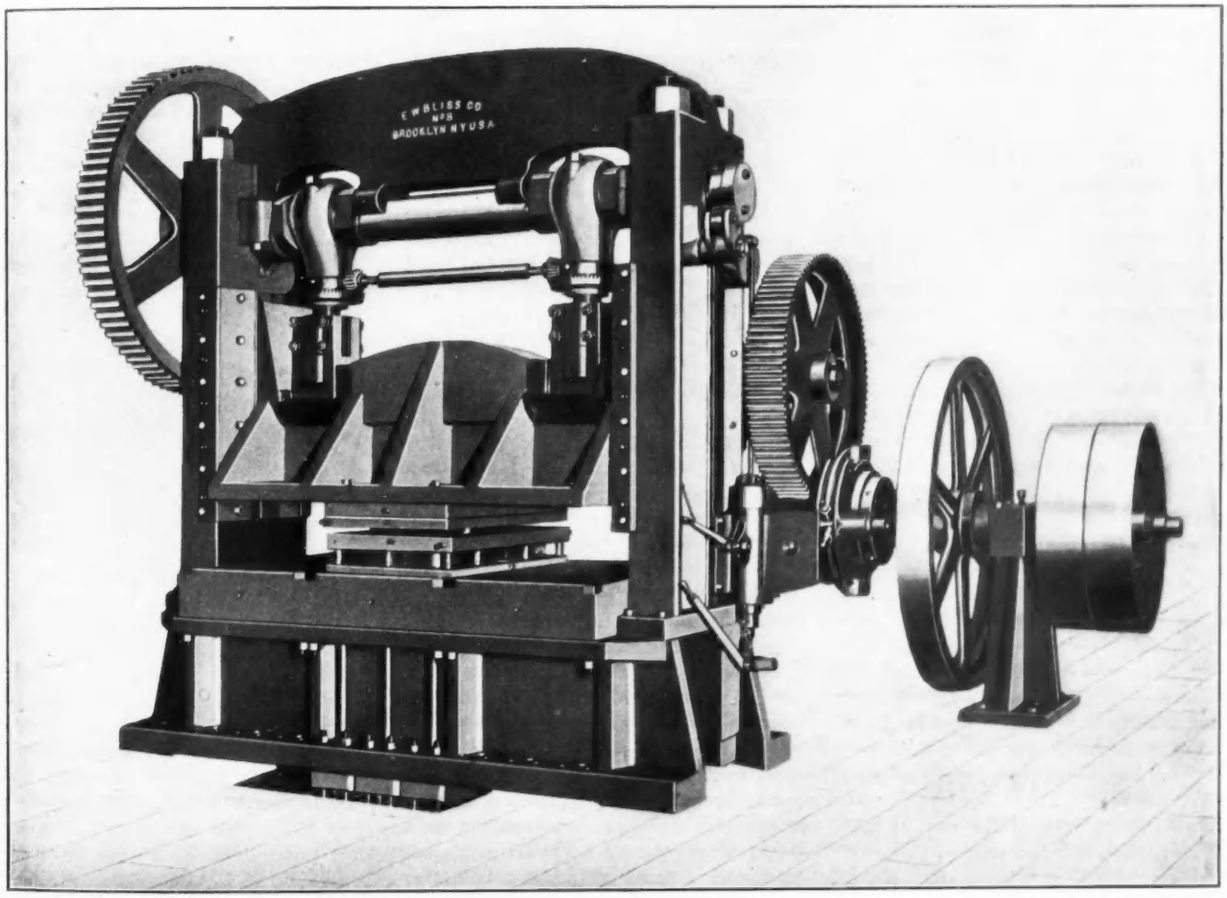
Up to this time an air pump, about 2½ inches bore and 5 inches stroke, had been used when getting up steam. This was worked by hand, and ten or fifteen minutes' pumping against 15 or 20 pounds pressure is no very attractive job. After air pressure has thus been obtained in the boiler, the valve *C* is opened and the compressed air passes through *A* and out at *D*. The oil supply is connected to *B*, and the fuel passes into the furnace *E* in the form of a fine spray. The air pump is kept going until enough steam is generated to supply the atomizer, when the valve in the pipe leading to the pump is closed, and the boiler goes ahead unaided.

To the branch on the pipe *A D* is screwed the 3-inch hollow copper ball *G*, with a cover *H*, which has a few holes near the attached pipe. During the day, when the engine is running, *G* fills with "liquefied steam," and the following morning when starting up it is all ready for lighting the bunsen burner on the gas branch underneath.

To get up steam, the valve *C* is closed, as well as the atomizer plug at *D*. Then the bunsen burner under *G* is lit and pressure is generated by the ball. A small

steam gage is connected to *A D*, and when pressure gets over 25 pounds the plug at *D* is withdrawn by the atomizer stop. Such a ball will get up steam on a boiler of the size in question very readily, and is most attractive to the man who has the job of getting up the initial pressure in early morn. As soon as the boiler pressure climbs up to the atomizer gage the valve *J* is closed and the valve at *C* is opened.

We found that the boiler tubes coated less with soot by the method here described than by the old air-pressure system. Steam as an atomizing force may have a better effect in promoting the combustion of the crude oil used than air for the same purpose. The steam donkey boiler, anyway, maintains a higher and more regular pressure, and when applied is not to be removed for the older way at any price.



A LARGE CRANK PRESS.

A Large Double Crank Press.

The press shown in the half-tone is the largest of its type ever built, weighing about 85,000 pounds. It embodies all of the up-to-date ideas in the design and construction of presses of this class, and embraces several novel features. The press has been designed and constructed for stamping out and drawing steel radiators of various sizes, a new line of work. The drawing die for the smallest size of radiator is shown in place. This class of work would naturally call for a double action drawing press, but by means of the springs shown under the bed of the press work up to 3½ inches deep can be drawn. Another feature of interest is in the clutch mechanism. This is so arranged that it may either be operated automatically, by one depression of the lower hand lever, or by a slight change of the working parts and then the depressing of an upper lever, be made to start and stop anywhere at the will of the operator. The latter arrangement is used in setting dies and such work, as it provides for absolute control of the movement and the stoppage at any point of the stroke.

The frame of the press, on account of its size and weight, was necessarily built in sections, the principal parts being the bed, the two uprights, the crown and the four steel rods which take the strain of the press. The weight of the mandrel, exclusive of the dies, is 12,000 pounds. The bolster is built in three sections, each of which weighs 3,000 pounds. The distance between the uprights is 8 feet; area of top of bolster plate, 96x54 inches; floor space, 18 feet by 7 feet 6 inches; hight from floor to top of gear, 13 feet. The floor line should be in line with the top of the brick pier supporting the outboard bearing. This press has just been completed by the E. W. Bliss Company, of Brooklyn.

Letters from Practical Men

The Scheme Book.

Editor American Machinist:

I have often wondered if our machinist friends ever think of keeping track of the ideas relating to the improvements in machinery which come under their notice. There is hardly any machinist who does not, at one time or another, see a weak place in a machine, or a movement, or a point in construction which could be improved upon. Inventors, as a rule, see only the means to get at the end, and often make machinery that, while doing the work, still has many defective or badly designed parts. In the leisure hours which many have while work is running, I think it a splendid idea to have what I call a "scheme book;" that is, a rough, unruled book in which I can put down at the time the ideas coming to me, and later use it or throw away, as I may see fit. All men see things differently, and the machine from one man's brain may be, and generally is, wonderfully simplified by others who have to deal with the same machine. To have a scheme book and to use it is to accumulate a large mass of sketches, descriptions, notes, etc., that, either at the time or in the near future, will become valuable.

Again, the practical man has to do many

things and to get over many places not set down in the textbooks, and it is a good "scheme" to mark it down. In doing this it imperceptibly leads to a desire for research, discovery, invention, and, before you are aware of it, you are producing new ideas, new machinery, new articles for use in commerce, the trades or the home. It cultivates a desire to make sketches, figures, improves one's acquaintance with mechanical movements, and broadens one's ideas of machine construction. One can have no idea how helpful it is when you happen to find yourself in a strange shop, with no drawing and nothing but your own ability, to construct, first on paper by sketch, and then to read to your customer by means of a sketch your idea of the matter under discussion. The scheme book enables you to gather together a mass of ideas that cannot well escape you after having been put down, and in years to come you will see the good of following up this line of thought and development.

If you are a foreman and discover short cuts to reach the conclusion of a job, put it down in your scheme book. You will avail yourself of it when you run your own shop. The scheme book gives you a fund of expedients to draw from when any unforeseen difficulty presents itself, and becomes a new problem. It gives versatility and resource, and fits you to occupy positions of trust and responsibility. It is to be regretted that so many mechanics who have a decided turn for improved ways of manufacture or more efficient shop methods are letting valuable ideas pass with scarcely a notice, when a scheme book would retain them until wanted. It is the experience of nearly every mechanic, who has had any experience at all, that machinery is constantly coming to his notice, and patented, too, that once had occurred to him, and not preserving it, had come to be profitably used by another.

By all means, keep a scheme book and sketch all new ideas coming to you, and the advantage will grow upon you. Ready acquaintance with pencil, paper and records will make your services more valuable and bring you into a larger field of action.

C. A. BURTON.

Kansas City, Mo.

Molding Locomotive Driving Wheels.

Editor American Machinist:

I enclose sketches illustrating the molding of a locomotive driving wheel. Fig. 1 shows the nowel of a mold ready for the cores. Fig. 2 is a cross section of Fig. 1, with, however, center core and arm cores in position. Fig. 3 is the top part of the center core that goes over the ends of the arm cores and completes the whole center core. Fig. 4 represents the cope turned over and ready to close over the nowel, with the anchor plates wedged securely to the bars, etc.

Locomotive driving wheels vary as to shape, size and the location of the counterbalance. Some are cast without counterbalances; what is determined for counterbalance weight is bolted between the arms after the wheel is cast. Others have the counterbalance cast in the wheel, provision being made for the shrinking of unequal portions by cutting the rim in two each side of the counterbalance. Some counterbalance parts are cored, to enable lead to be poured in, to increase or adjust the counterbalance to the right weight. Driving wheels have been made with counterbalance cast in, and have also been cast with the rim solid. The internal and inevitable strains ensuing, of course, The

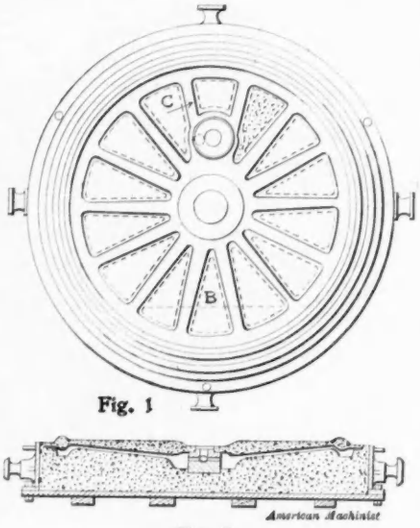


Fig. 1

Fig. 2

THE NOWEL.

thick counterbalance would be the last to cool, thereby drawing from the thinner portions of the rim. Water has been applied to hasten the cooling of this thicker portion, and the same is often done with wheel and pulley hubs to hasten the cooling of the thicker portions. This has sometimes been carried too far, as in the case of some twenty odd driving wheels that were cast with three counterbalances, being the entire space between the arms, and the rim cast solid. Water to cool the counterbalance was plentifully and judiciously used. Most of the wheels were bored, but when it came to pressing them on to the axles they burst like paper bags. The cooling by water is a doubtful expedient, especially in the case of locomotive driving wheels. These were wheels for freight engines, and it was done some years ago; perhaps it is not now being attempted, with driving wheels at least. There are a great many driving wheels cast now of steel, with counterbalance cast in; some with counterbalance as shown at dotted line *B*, Fig. 1, with rims cut at either side and close to the counterbalance. These should last "forever and aye." To facilitate the molding and the securing of the mold, plates are provided, to be placed between the arms as shown by the dotted lines on the joint between the arms, Fig. 1. These plates have two irons in each, with eyes in the top ends sufficiently long to come above the top of bars in the cope. When the cope is rammed, and before lifting, rods are placed in the eyes at right angles, wedges inserted and made secure, as shown in Fig. 4.

Patterns are better solid than split. They keep shape better, are less liable to injury, and with good appliances are more expeditiously molded. Where whole flasks are used to mold driving wheels a follow board is necessary. The board should be thick and strong, to prevent twisting when laid down on the bed, so that the pattern will not spring when being rammed up, nor the board sag when the nowel is turned over.

There is much said among molders

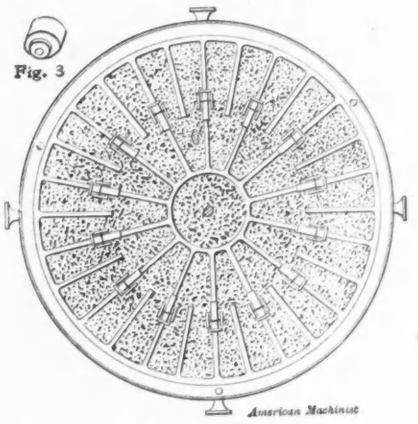


Fig. 4

THE COPE.

about luck; but, of course, everyone knows that there is no cause without its effect, and the reliance upon or the resigning to chance is a pretty poor qualification for a successful molder. Here follows a true tale of foundry experience: A molder who for three years had had an enviable success in molding driving wheels, whose loss of castings was not over 1 per cent., and then largely from broken cores, one morning had his attention called to a short arm on the wheels cast the day previous. Each wheel had one short arm. It was shelly at *C*, Fig. 1. Of course, interest was excited, and search was begun soon after that day's cast to learn if what they didn't want to find was there. It was there unmistakably, but being found thus early it was mended by burning in more iron; but it made a blemish on the casting, and also on the molder's mind. After every care and core inspection, the unwelcome visitor appeared day after day on his three wheels, and on the same arm. There were no traits of superstition about the foundry, but in this molder there was something wrong somewhere. The foreman was consulted, and

he decided, without leaving his seat and with no hesitancy whatever: "You ram your copes too blamed hard, or your sand is too wet." The molder said: "Would you please ram one cope to-morrow over that particular spot and let us have an object lesson in cope ramming?" He rammed a cope the next day, and when the wheel was examined there was the same d——d spot, or even worse. It is to be remembered that in those short arms the cores were not longer than the crank pin hub, but there was a good riser that was diligently churned upon the crank pin hub, as shown by the dotted lines, Fig. 1. The molder tried every known or suggested experiment to remedy this annoyance. At last one day three ½-inch rods were punched through the cope to make three small risers on top of the short arm. That day saw a sound wheel cast. After a while two of the risers were enough; then one seemed sufficient. In a week or so there came some cause for the molder to hurry, and the ½-inch punched risers were forgotten; but the arm came sound, and continued to come sound thereafter, and ever since the question with him has been: "I wonder why? I wonder why?"

L. C. JEWETT.

North Attleboro, Mass.

Crank Shafts for Large Engines.

Editor American Machinist:

In criticising what I wrote on this subject I do not think that Mr. Knox has quite grasped my meaning. I found the unit pressure of 130 pounds by observation of many satisfactory examples of engines in which large and heavy wheels were employed and the crank shafts were of sufficient strength. I made no reference to the modifying factor of heat, because the examples I had taken, from which I found the pressure in question, had been developed from long practical experience, in which we may suppose the effects of heating had, directly or indirectly, been allowed their proper effect. I think that Mr. Knox will increase the value of his criticisms if he will give the size of the large engines in which the pressure is so much as 1,200 pounds per square inch of projected area of bearing at a velocity of 3 feet per minute. My experience of large engines is somewhat limited, extending chiefly to engines of 1,000 to 2,000 horse-power at rates of rotation of 60 per minute and upwards, and therefore outside the slow rubbing speeds of 3 feet per minute, and very far below speeds of 1,200 feet per minute. I must disclaim any intention of having put forward the 130 pounds unit pressure as suitable for such extreme rubbing velocities as 3 feet and 1,200 feet. I particularly referred it to the crank shafts of large engines, and as such it was unnecessary to say anything about speed, or it might have been pointed out that in these same engines the pressures on the crank pins will be up to 1,000 pounds, which is rendered possible by the reversal of pressure on the pin bearing and the more easy entrance of oil to the pin than to the crank shaft bearing.

Pressures ought never to be so excessive that water cooling is constantly necessary. Such water cooling may, it is true, prevent dangerous heating, but it only conceals the fact that there is going on an excessive conversion of work into heat. If any reader of the "American Machinist" should happen to possess any water jacketed bearings he can very well figure out the work lost in friction by measuring the flow of water passed through the bearing jackets in one minute, and noting the difference of temperature of the ingoing and outflowing streams. Thus one gallon, or 10 pounds, of water per minute escaping with an accession of 10 degrees of temperature represents a continual expenditure of over 2⅓ horse-power. Mr. Knox may now see that in the figure I gave the points which govern pressures were not ignored. They were all included, for the very simple reason that the figure was obtained, as distinctly stated, from large engines. Mr. Knox also credits me with having proposed to balance the weight of an armature by setting it out of magnetic balance, and he then proceeds to demolish the idea by stating its evils. Now, this is unfair, for I never advised such a procedure; all I did was to state that if the armature is to have any magnetic want of balance, such as it does have should be upward. It will be remembered that the argument for excessively large bearings was that they must take the load also of the downward pull of magnetic non-balance. If, therefore, it is considered so difficult to put an armature in true balance, it can at least be insured that its initial error shall be such as to be self-corrective with time.

The ample bearings advised by Mr. Knox—by the way, this word ample savors very much of the vague generalities of specifications—have unfortunately been taken to be excessive bearings in some recent practice, and have led up to excessive, or at least unnecessary, velocity of rubbing and demanded such further excessive length as was then required to fit the bearing pressure to the velocity in the evil cycle Mr. Knox so well points out. I am, however, still of the belief that the enormous shaft diameters that have become the fashion have arisen from the bad practice of throwing the stress alternations and the flywheel effects upon the shaft in place of rigidly connecting the armature to the flywheel, and thus protecting the shaft from such stresses. In looking up some old data, I find that in a well proportioned beam engine of about 500 horse-power the beam centers had bearing pressures of 860 pounds per square inch of projected area, and the shaft oscillated perhaps 60 times per minute—through an arc of about 36 degrees, or about 14 feet per minute. In such bearings the pressure would be alternately relieved, the upstroke of the engine lifting the beam center against the caps.

Other bearings in these same engines with still less movement did not have an area of more than 50 inches for about 114,000 pounds, or over 2,000 pounds unit pressure. These also were alternately relieved of all load. Indeed, I have often thought that a study of the proportions of a beam engine that had been evolved by long years of experience in their actual wear is one of the best possible aids to a comprehension of the principles underlying the art of lubrication, because in these old engines there were so many parts all transmitting the same pressures at such different rubbing velocities that the effect of such factors was evident in the proportions that practical experience had shown to be necessary. Probably one reason why such engines were so durable was that no bearing existed in the engine that was not exposed to alternation of stress, and this favored lubrication, though it was very little lubrication that many of them obtained, for many of the parts had no oil cups, and even the oiling of the crank pin was dependent upon the skill with which the engineer synchronised the swing of his arm with the rotation of the crank. The only bearing that received a more steady lubrication was that in the wall behind the flywheel, and oil was supplied to this down a long pipe, which, no doubt, served to lengthen out the period of flow.

In my early days of steam engineering I was accustomed to speeds of rotation of 19 per minute. One of my early jobs was to assist in speeding up a pair of beam engines that had a stroke of 8 feet, from 18 to 26 turns per minute. To-day I have to do with only three engines moving less than 200 per minute. I am by no means very sure that with all the speed and high pressures of to-day we are doing very much better than we should do if we applied our present experience to slow speed engines. The tendency is to expect too much from high pressures and high speeds. They have certainly complicated the question of lubricating, both inside and outside the cylinder.

London. W. H. BOOTH.

A School Shop for Advanced Mechanics.

Editor American Machinist:

I have been greatly interested in the articles that have appeared in your paper on the education of mechanics.

I believe the time has come when this country must take steps to educate her mechanics, if she expects to keep her place at the head of the procession, mechanically speaking. But there is another phase of the subject that I would like to see discussed in the columns of the "American Machinist," and that is, a school shop for men who are already good mechanics, men who have worked in a shop for from six to ten years; who have

reached the top where they are, and are longing for a chance to fit themselves for higher positions, not for the few extra dollars per month involved, but because they are in love with their work—because they have "wheels in their heads" and can't help it and are glad they can't.

Such a school shop, or shop school, whichever you like, should be a manufacturing shop, doing a large variety of high-grade work where students would work half-time and study half-time. The shop should be run with the idea of making money to enable men without means to at least partly pay their way and help support their families if they have them.

Such a school would draw together the pick of the shops of our country, men with ideas of their own, each one to contribute something for the good of the rest.

What an influence such a school would have on our success as a manufacturing nation, and what a chance it would give for men to fit themselves to take charge of our great industries!

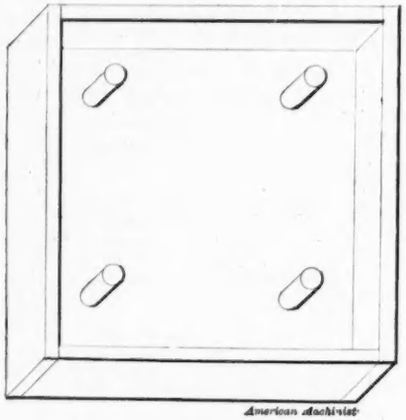
If there is a philanthropist who wants his name to go down to posterity as a public benefactor, let him provide the means to start such a school, and future generations (of mechanics) will rise up to call him blessed. W. L. EDGAR.

Webster City, Ia.

More About the Swelling of Cores.

Editor American Machinist:

The articles of March 8 in answer to my question of February 8 were read by me with much interest. In reply I will ask those gentlemen to try an experiment, and see if the result is as they describe.



A CORE BOX FOR AN EXPERIMENT.

I found that it was not. Consult a practical molder and see what he will say. The settling of cores as described by Mr. Baden I make use of at present, and I have also visited a number of shops, and have found in them all that an allowance was made for the swelling. If Mr. Orton is surprised at the question of mine, I wish he would run up against some of the men that I have; he would be more than surprised. The experiment which I suggest is as follows: Make a box 24x24x1½ inches; in the corners put four round dowels about ¼ inch in diameter; on the top of these mark a center. Have a core made, and measure before dumping core out, and then measure again after it is baked, and see what you will find. I send a sketch showing the box. It would be interesting to hear from these gentlemen again. G. H. WILLARD.

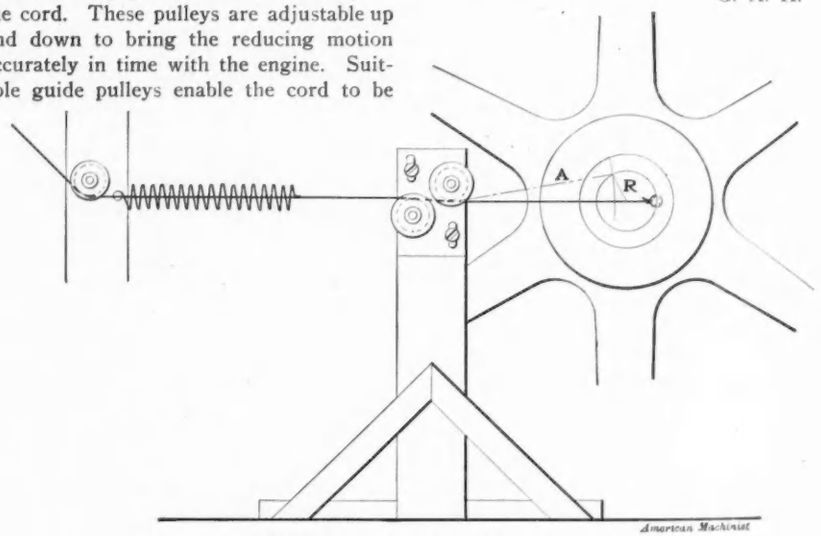
Indicator Rig for Gas Engines.

Editor American Machinist:

Gas engines should have permanent indicator attachments, especially in the larger size, but few have them. The writer has found the following device very useful as it can readily be adapted to any engine:

Tap into the end of the crank shaft about in line and on the same side with the crank pin, for a small pin having a groove near the outer end to receive a wire loop on the end of the cord. Two grooved pulleys guide the cord, and give, at one position of the pin, the same ratio between the cord A and radius R that exists between the engine crank and connecting rod. If this position is at about one-third the forward stroke, the errors on either side will be small and of such nature as to neutralize those due to inertia of the paper drum and elasticity of the cord. These pulleys are adjustable up and down to bring the reducing motion accurately in time with the engine. Suitable guide pulleys enable the cord to be taken to any part of the engine, and a light coil spring through which the cord passes keeps everything up to its work. This simple apparatus will give a more accurate card than many of the more pretentious devices, provided the engine shaft is not so weak as to wabble excessively, which is all too common a fault.

F. D. H.



INDICATOR RIG FOR GAS ENGINES.

The Right-Angle Triangle Again.

Editor American Machinist:

Having seen in the "American Machinist," No. 14, a new proof of the Pythagorean proposition, I want to offer an old one which I once saw in the "Popular Science Monthly." It is said to come from the Far East, and to antedate, perhaps by many centuries, Pythagoras and the *Pons Asinorum*. It is so simple that no knowledge of geometry whatever is needed to understand it.

If we arrange four equal right-angle triangles as shown in Fig. 1, it is apparent that we form a square having for its side the sum of the long and short sides of the triangle, and the area not included in the triangles is the square of the hypothenuse.

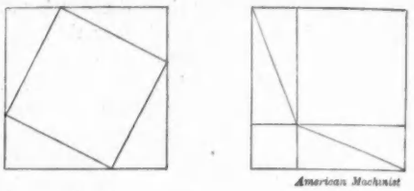


Fig. 1 Fig. 2

A DEMONSTRATION OF THE RIGHT ANGLE TRIANGLE.

If we arrange the triangles as shown in Fig. 2, it is apparent that our square is of the same area as before and that the area not included in the triangles is equal to the sum of the long and short sides of the short angles. Hence, the square of the hypothenuse is equal to the sum of the squares of the other two sides.

G. A. H.

Convict Labor Bills in Congress.

A lively interest is being manifested in the several bills now pending in Congress which have for their object the regulation of commerce among the several States and territories in the products of convict labor and the protection of free labor from convict competition. An epitome of the two most important measures along this line is herewith presented. The Gibson bill provides that all goods, wares and merchandise made or manufactured, in whole or in part, in any State or territory by convicts shall, before transportation from the place wherein manufactured or made into any other State or territory of the United States, be labeled, branded, or

stamped, or the package containing the same shall be labeled, branded, or stamped in a legible and permanent manner where it can be plainly seen and easily read: "Made by convicts at ———," giving the name of the place and State or territory where made. It further provides that all goods, wares and merchandise made or manufactured, in whole or in part, by convicts, when transported into any State or territory, which shall be used, consumed, or sold therein, shall, upon arrival in such State or territory, whether in original packages or not, be subject to the laws of such State or territory to the same extent and in like manner as though manufactured or otherwise produced in such State or territory, and shall not in any way be exempt from said laws because transported from one State or territory, or because transported in original packages. Such articles transported into any State or territory in violation of this act shall be forfeited to the United States, unless first seized under the laws of the State or territory violated by such transportation; and every person who knowingly violates or aids or abets in violating this act shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not more than $1,000.

The Noonan bill provides, in effect, that every person who knowingly transports, or causes to be delivered for transportation, for commercial purposes, from any State or territory in which they are in whole or in part manufactured, any goods, wares, or merchandise, in whole or in part the product of convict labor, in any penitentiary, prison, or other establishment in which convict labor is employed, into any State or territory, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than $250 nor more than $500, or by imprisonment not exceeding one year, or both, at the discretion of the court, and such goods, wares, etc., shall be forfeited to the United States. A. F. T.

Legal Notes—Dangerous Passageway—Accident Oiling Band Saw.

BY W. MARSTON SEABURY.

The second appeal in the case brought by Charles Dolphin against Charles Plumley and others was recently decided by the Supreme Judicial Court of Massachusetts.

According to the plaintiff's evidence, he was injured while passing over a movable platform or apron, one purpose of which was to prevent splinters and chips thrown off by a circular saw from falling below and clogging the machinery, and while so crossing the apron it sank down a little, owing to its not having been properly replaced by one of the defendants. He fell and his hand struck the saw.

In its former opinion the Appellate Court said, "To pass in such close proximity to the saw was obviously dangerous, and if other ways had been provided, we should hesitate to reverse the ruling below." At the second trial, therefore, the defendants introduced evidence to show that there were other ways than the passage over this apron to reach the place plaintiff desired to reach—one inside the mill between one of the side walls and the carriage which carried the logs, and the other by going outside of the mill. A witness was asked, "Is it proper, within your knowledge and experience, for these two screens and stepping over this mechanism to be used as a passage-way?" To this question the answer was, "No, sir; not unless a man wants to commit suicide." The jury brought in a verdict for the defendants, which would indicate that they considered the plaintiff guilty of contributory negligence, and the Appellate Court refused to disturb the verdict. (56 N. E. R. 281.)

ACCIDENT OILING BAND SAW.

In the case of Buttle against the George G. Page Box Company, the Supreme Judicial Court of Massachusetts recently rendered its decision.

Plaintiff was ordered to oil a band saw about 2½ inches in width while it was in motion. He was not to touch the saw, but was to pour the oil into a little cup which was on top of one of the feed rolls nearest the saw. He attempted to reach the saw from behind, and his hand came in contact with the saw and was injured.

Buttle brought suit against the box company, by which he was employed, in the Supreme Court of Suffolk County, and the case was submitted to the jury upon the following instructions:

"If the plaintiff was ordered by Gillis to oil the band-saw machine while it was in motion, and in obedience to such order attempted to oil the machine, and the work of oiling the machine while in motion was more dangerous than the work he had been employed to do, and had done up to the time of the giving of such order, and the plaintiff, by reason of his youth or inexperience, was incapable of appreciating the increased danger to which he exposed himself, or of doing the work safely without instructions or cautions, which he did not receive, the plaintiff may maintain this action, provided the jury find that there was no negligence on his part."

Upon this charge of the trial court, the jury brought in a verdict for the plaintiff, and the defendant appealed.

The Appellate Court held that the jury were not warranted, upon the evidence before them in rendering a verdict for the plaintiff based upon the charge of the trial judge, and held that the defendant was entitled to a ruling that the plaintiff was not entitled to recover. (56 N. E. R. 583.)

The production of aluminum in the United States in 1899 was 6,500,000 pounds, which is an increase of 1,300,000 pounds over the output of 1898.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(13) H. L. F., Wilmerding, Pa., writes: (1) A and B each have a taper screw to make, of the same size, taper and lead. A uses the taper attachment and B sets the footstock over to get the desired taper. Will the lead of the screws be the same in both cases? A.—This matter has been explained in our columns long ago; but it may not be amiss, for the sake of younger readers, to consider it again. The leads of the two screws will not be the same, as will appear from the sketch, in which Fig. 1 represents A's mode of cutting the thread and Fig. 2 shows B's way of doing it. Assuming the taper part in each to be 1 inch long, and that the pitch of the thread is 10 to the inch, we have in the first case precisely 10 threads for the length on the line *a b*, on the parallel line *c d* and on the line *e d*. As the line *c d* is of the same length as *a b*, the line *e d* be-

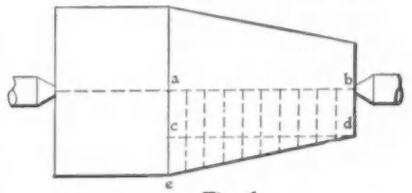


Fig. 1

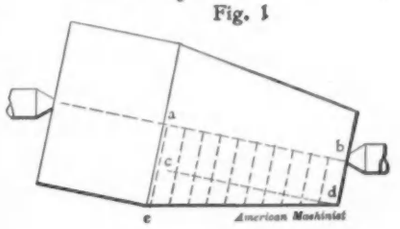


Fig. 2

ing longer than *c d* is also longer than *a b*. We have here, therefore, 10 complete threads upon a line which is longer than 1 inch, or less than 10 threads to 1 inch of length, measured on the surface of the screw. In Fig. 2 we have more than 10 threads to the length of the line *e d*, and more than 10 threads also to the length *a b*, or the pitch of the screw measured parallel to its axis will be more than 10 to the inch. This screw therefore has a somewhat finer pitch than the other, although both screws are cut with the lead screw geared for 10 to the inch. (2) Assuming either method to give the correct pitch, how can the same pitch be cut by the other method? A.—It is not usually practicable to do so. The first thing to do is to ascertain the exact pitch in either case. In Fig. 1 we may assume the small diameter of the taper to be .5 inch and the large diameter to be .9 inch, which corresponds to the proportions drawn. Then the length of *c e* is .2 inch, and the length of *e d*, the hypothenuse of the right-angle triangle *e c d*, will be:

$\sqrt{(e\,c)^2 + (c\,d)^2}$ or $\sqrt{.2^2 + 1^2} = 1.0198$.

Then, to cut by the second method the pitch produced by the first method, or 10 to the inch, measured parallel with the axis, the lead will be: 1.0198 : 1 :: 10 : 9.8058 threads to the inch, which it would not be easy to find the gears for.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 20.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

D'ftsmans booklet. D.J.Kelsey,New Haven,Ct.

Shaft'g straighteners. J.H.Wells,Tampa,Fla.

Eye benders, angle benders, hand bending tools. Estep & Dolan, Sandwich, Ill.

U. S. and Canada patent for sale, $150. Address Box 240, AMERICAN MACHINIST.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Wanted—To purchase, complete drawings for six sizes of dough mixers. Address Baker, AMERICAN MACHINIST.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Two crank planers (Draper M. T. Co. preferred) in first-class shape. National M. & T. Co., 253 A st., Boston.

Wanted—A small second-hand metal planer for model or experimental work. Address giving details and price, Box 21, AM. MACH.

U. S. patent (small tool) for sale or on royalty ; selling well in Europe. Herbert, Cornbrook Park Works, Manchester, England.

Wanted—Second-hand lathes, gas engines, drill presses, motors ; state condition, price and name of maker. H. Bertrand, Box 27, Glen Ridge, N. J.

Wanted to Buy—The controlling interest in a manufacturing business, light machinery or hardware, from $75,000 to $100,000. Address J. H. D., care AMERICAN MACHINIST.

Complete Locomotive Drawings.—I wish to dispose of all the working drawings of a locomotive ; ready to work from ; sent upon application for examination. Box 10, AM. MACH.

For Sale—A double annealing and case-hardening furnace of Brown & Sharpe's latest pattern, in just as good order as when new ; prices and terms very reasonable. Address Eclipse Bicycle Co., Elmira, N. Y.

"Loetzer's Hand-Book of Practical Rules and Tables for Machinists and Engineers" ; revised and enlarged fifth edition just out ; cloth binding, 65 cents ; full leather binding, $1 ; agents wanted. C. E. Loetzer, Sayre, Pa.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman, experienced in machine tools, wants a position. Box 16, AMER. MACH.

Designer of heavy machinery desires steady position. Address "S.," AMER. MACHINIST.

Experienced draftsman and designer, technical graduate. Box 15, AMER. MACHINIST.

Mechanical engineer and designer of 20 years' experience, desires position. Address E. F., AMERICAN MACHINIST.

Steam engineer and millwright of experience and ability, wants position, mill or factory ; economic methods. C. A., AM. MACH.

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A brass-foundry foreman desires a position ; well up in valves, cocks, etc. ; have good reasons for desiring change. Address "Zinc," AMERICAN MACHINIST.

Wanted—Position as foreman, tool room ; had experience on jigs, fixtures, subpress dies and small machinery ; good references. Box 343, AMERICAN MACHINIST.

Mechanical draftsman, 23, technical graduate, 3 years' experience ; position as above, or equivalent ; distance no objection. Address "Permanent," AMERICAN MACHINIST.

Wanted—Position as foreman, by first-class toolmaker and machinist ; experienced on fine machinery, dynamos, tools ; best references. Address Box 18, AMERICAN MACHINIST.

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A mechanical superintendent with a good practical experience is open for an engagement ; 8 years in last position ; habits correct ; references excellent. Box 341, AM. M.

Middle-aged machinist, of large experience, wants position as general foreman with concern building steam engines or machine tools ; unquestionable references. Box 19, A. MACH.

Mechanical engineer, with technical education, 18 years' varied and successful experience, now in responsible position, desires a change ; highest references. Lock Box 1, Glen Ridge, N. J.

General machine shop foreman is open for position ; thoroughly practical ; good manager of men ; well up in matters of cost of production ; best references. Address "Method," care AMERICAN MACHINIST.

Designer will shortly be open to engagement ; technical education ; 16 years' experience ; thoroughly conversant with up-to-date practice from the drawing office to the salesroom. Box 20, AMERICAN MACHINIST.

Superintendent, of large experience in the management of machine-building plants, now open for engagement and invites correspondence ; well up in designing ; capable, energetic, thoroughly reliable and familiar with best modern practice. Box 14, AM. MACH.

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A mechanical engineer, 43, broad experience, desires to make permanent arrangements to represent some house or houses on West Coast ; has been a salesman, also contractor for machinery ; can give good bond and references. Address F. H. Whiting, Tacoma, Wash.

Thorough and energetic mechanic, 15 years' experience as toolmaker, designer and chief draftsman, of high degree of executive ability, thoroughly familiar with the details of the manufacture of machine tools and automatic machinery, desires correspondence with a view to change of present position. Box 17, AMERICAN MACHINIST.

Help Wanted.

Wanted—Good mechanical draftsman for pump work ; must be No. 1. Box 287, AM. M.

Wanted—Foreman, thoroughly experienced in the rolling, drop-forging and drawing of copper. Box 11, AMERICAN MACHINIST.

Wanted—Mechanical draftsman in machine shop in New York ; please state age, experience and salary expected. Box 339, AM. M.

Wanted—Toolmakers on tools for small interchangeable work ; state age, experience and wages expected. Box 12, AMER. MACHINIST.

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Draftsman ; good position ; New York City ; young man having some years' best experience in machinery ; must be highly recommended ; state references. Box 22, AM. M.

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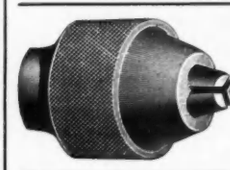

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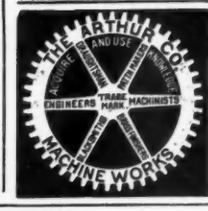

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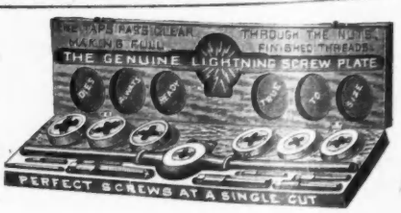
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